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AUTHOR Quinlan, Susan E.
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ABSTRACT

The ecological theme of "We all need each other--the web of life" serves as the focus of Alaska's fourth annual wildlife week and as the emphasis for the activities in this guide for upper elementary teachers. The packet of materials contain: (1) an introduction (explaining the theme); (2) table of contents (indicating each lesson's objective and the location of its background sheets, students worksheets and activities, and curriculum integration ideas); (3) list of worksheets (providing titles, summaries, and page numbers for the 11 activities); (4) worksheet solutions (listing answers and/or explanations for each of the exercises); (5) glossary (offering an illustrated dictionary of selected ecological terms); (6) ecosystem crossword puzzle; (7) lessons (containing objectives, background information, vocabulary list, activities, and curriculum integration suggestions); (8) ideas and references for ecosystem investigations (suggesting techniques and phenomenon to explore in the outdoors); (9) classification guide (explaining the four kingdoms of living things); (10) Alaskan food chain and food web examples (citing specific relationships common to four ecosystems); and (11) references. (ML)

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Alaska Wildlife Week

UPPER ELEMENTARY TEACHER'S GUIDE

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Unit 4. We all need each other -- the web of life. **April 20-26, 1986**

Alaska Dept. of Fish and Game -- Game Division -- Nongame Wildlife Program

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Susan E. Quinlan
Nongame Wildlife Program
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Alaska Wildlife Week 1986
Introduction

This is the fourth annual Alaska Wildlife Week . This annual celebration of the importance and value of wildlife to Alaskans is a time for learning about wildlife and conservation. In recognition of this event, the Alaska Department of Fish and Game, Nongame Wildlife Program annually prepares a new set of educational materials for teachers throughout the state. We began developing the packets in response to teacher requests for Alaska-specific information on wildlife and conservation. Originally patterned after the National Wildlife Week sponsored by the National Wildlife Federation, Alaska Wildlife Week has continually evolved in response to teacher's needs, requests, and evaluations. We hope that these 1986 materials are the best yet.

Separate Primary, Upper Elementary, and Junior/Senior High School Teacher's Guides were prepared this year to make the materials easier for you to use during Alaska Wildlife Week, and throughout future years. Be sure you have the appropriate Teacher's Guide. Also included are more posters, many easy to duplicate worksheets, and a wide variety of activities for use with your regular curriculums. This year's packet is organized so that each lesson builds on the previous ones. The activities are intentionally varied to meet the differing needs of teachers and students throughout Alaska. Feel free to pick and choose among the materials based on your particular situation and your students. Adapt and modify activities or worksheets if you desire. The important thing is to get the concepts across.

As always, we would like to encourage you to integrate Alaska Wildlife Week with other conservation education materials-- Project WILD, Alaska Sea/River Week, CLASS Project, and National Wildlife Week all offer additional ideas, approaches, and perspectives on wildlife and the natural world.

The Alaska Wildlife Week 1986 theme is "We all need each other --the web of life." The unit is on ecology--the study of the inter-relationships among living things and their non-living surroundings. Ecology is a synthesis of many sciences and has application in all human endeavors. In learning to understand ecology, students will be challenged to think, question, observe, and reflect about wildlife--a topic in which most students are inately interested. The study of ecology can lead students to an interest and appreciation for all the natural sciences--biology, chemistry, and physics. Further, ecology is a science that is critical not only for for wildlife conservation, but also for the future of humans.

Never-the-less, ecology has been called "an elaboration of the obvious". Don't allow yourself to be frightened off by an occasional scientific-sounding word. Ecology is probably the easiest science to understand, and certainly one of the most fascinating. At some level, most people know the basic concepts of ecology without really being aware of it. Oddly, however, gaining an awareness of these intuitively obvious concepts is like putting on a pair of glasses that allow you to see the world as though for the first time.

Please use this packet and help your students put on a pair of "ecology glasses" that will let them see the world around them with new eyes.

P.S. Keep your notes, hang on to your packets, and incorporate your favorite lessons and activities into your curriculum. The Alaska Wildlife Week theme changes every year, but the information and materials in each year's packets continue to be relevant. In addition, the themes all center around wildlife and are interlocking. If you have saved materials from past years, you'll find many of them relevant to this year's Alaska Wildlife Week theme.

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1. Students will be able to differentiate living and non-living things and will recognize that an ecosystem includes both.	10	10	11 15-16	12-14
2. Students will be able to explain that plants and algae get the energy and minerals they need from the non-living environment.	17	17-18	21	22
3. Students will be able explain that energy and minerals from the non-living environment are passed between living things through food chains and webs.	23	24-25	26- 27	28
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NO#	WORKSHEET TITLE AND USE	PAGE
1	ECOLOGY CROSSWORD Students match words used in this unit to their definitions.	9
2	SECRET SCIENCE WORDS Students use a key to match number codes to letters then spell out the names of living and non-living things found in ecosystems.	11
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6	MAKE A LINK- WORKSHEET Students draw a picture of some living thing and answer questions about where the living thing gets its food and what living things eat it. Used in introductory activity.	26
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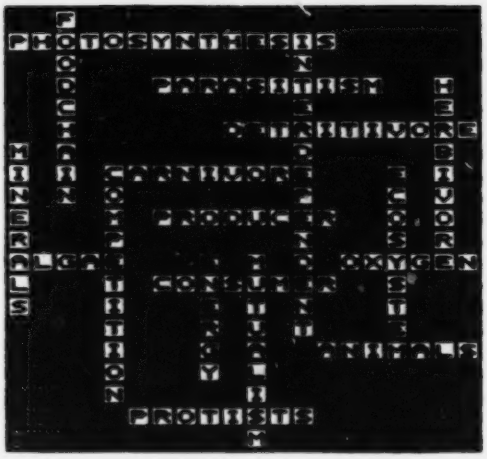
8	FOOD CHAIN MAZE Students find a pathway for minerals and energy from the non-living environment through a maze of producers and consumers, then back to the non-living environment.	28
9	ECOSYSTEM INTERACTIONS Students match the words mutualism, commensalism, parasitism, competition, and predation to their meanings, then classify 6 specific interactions. They check their answers by de-coding a message based on the letters of their answers.	38
10	MY FAVORITE LIVING THING Students use their understanding of ecology, and library references to fill in the blanks and show all the non-living and living things that are important to their favorite animal. Reviews and reinforces introductory lesson.	44
11	WHO NEEDS WHO Students demonstrate an understanding of ecosystem concepts by circling the living and non-living things that are important to specific living things. (They should circle all items.)	45

WORKSHEET SOLUTIONS



1. ECOLOGY CROSSWORD--

2. SECRET SCIENCE WORDS--Top row: air, sunlight, water, dirt; Second Row: plants, animals; Third Row: algae, fungi; Fourth Row: protists, fungi, monerans; Last Word: ecosystem.

3. LIVING THINGS BINGO--Self-explanatory.

4. LIVING THINGS WORKSHEET--Top row: 7-animal, 36-moneran,9-animal; Second Row: 48-fungi, 9-animal, 42-plant; Third Row: 3-protist, 6-fungi, 54-plant; Fourth Row: 6-fungi, 63-protist, 8-animal.

5. CONSUMERS NEED HELP--Students should draw in pictures of plants and/or algae.

6. FOOD CHAIN WORKSHEET--The four food chains are: diatom--copepod--herring-- seal-kiler whale--crab; willow--redpoll--merlin--mushroom; alpine avens--Dall sheep, wolf, raven; green algae--mosquito larvae--dragonfly larvae--stickleback--grebe--fox--bacteria. The bacteria and raven can be interchanged.

7. MAKE A LINK WORKSHEET--self-explanatory. Use information on page 56 to help students, if desired.

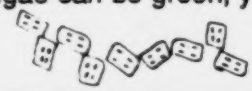
8. ECOSYSTEM MAZE--The line should pass through the Producer square first, then herbivores to carnivores to detritivores, then back to the bottom.

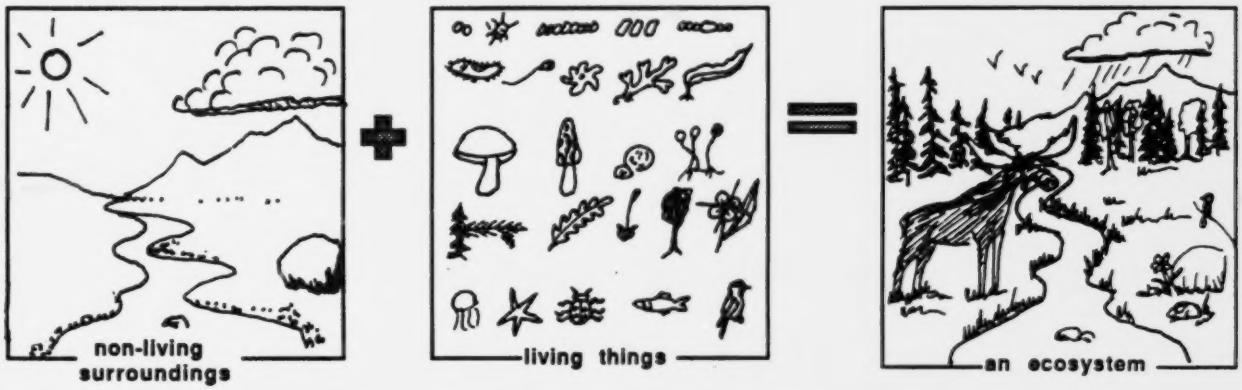
9. ECOSYSTEM INTERACTIONS--a--m; b--o; c--i; d--s; e--b; 1--a, 2--c, 3--e, 4--b, 5--d, 6--d. The word at the bottom is symbiosis.

10. MY FAVORITE LIVING THING--self-explanatory.

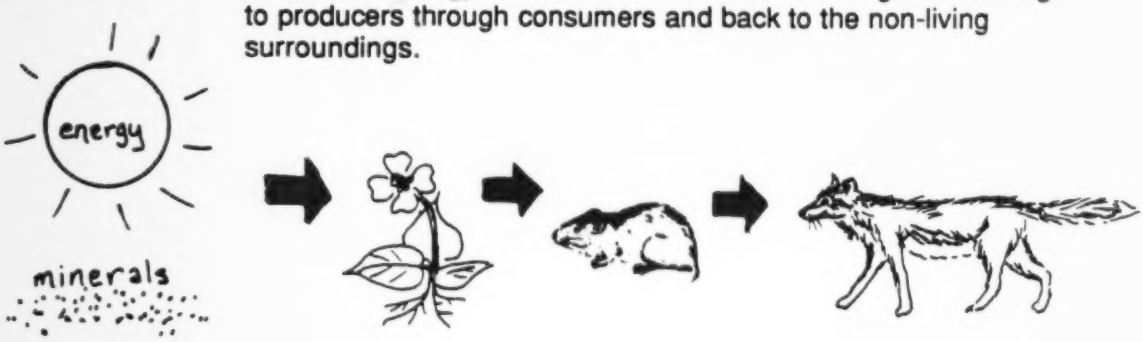
11. WHO NEEDS WHO-- Students should circle all the listed items. (Chickadee--The woodpecker digs holes for chickadee to nest in and depends on fungi to soften wood, (also to recycle minerals), all these need the tree for oxygen, chickadees and woodpeckers eat insects. Wolf--needs plants to produce oxygen and food for its prey, Dall sheep and other hoofed mammals, plants need insects to pollinate them and fungi and bacteria to recycle minerals. Weasel--eats voles, which eat berry-producing plants. The plants also produce oxygen. The plants need the fungi in order to take up nutrients. Harbor Seal--eats fish, which eat zooplankton, which eat algae.)

My Ecosystem Dictionary

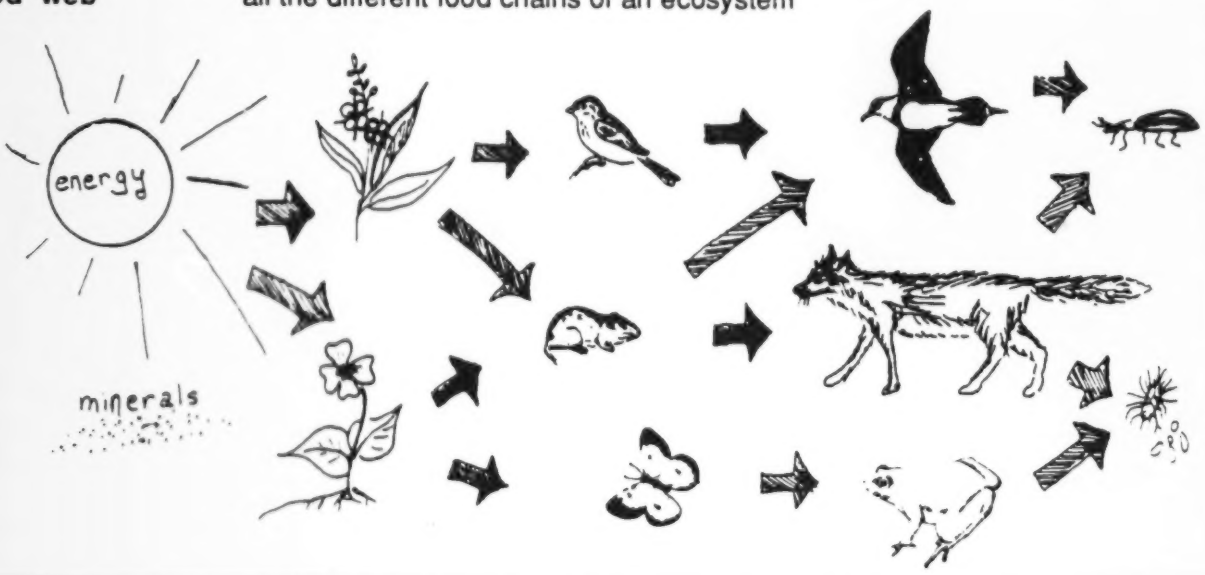
algae	a kind of living thing. Most algae live in wet places or in the water. Some just float around, while others grow on rocks. Some algae are too small to see. Some, called kelp or seaweed, are easy to see. Some algae look a little like plants, but they do not have roots or leaves. Algae can be green, yellow, brown, or red. 
animals	all the organisms in one of the 5 great groups of living things. All animals are big enough to see easily. Most animals move around a lot, and get food by eating other living things.
bacteria	a kind of microscopic living thing; many are important detritivores
carbon dioxide	a gas that most living things give off (breathe out). Plants and algae also breathe it in.
carnivore	a living thing that eats living animals or other consumers
commensalism	an interaction between two kinds of organisms from which one benefits and the other is unaffected
competition	an interaction between two organisms using the same, limited resource
consumer	a living thing that gets food by eating other living things
detritivore	a living thing that eats dead things and waste materials; sometimes they are called decomposers.
ecosystem	the non-living surroundings plus all the living things in an area



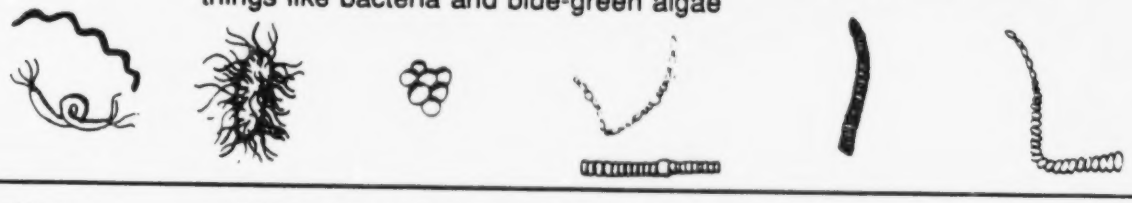
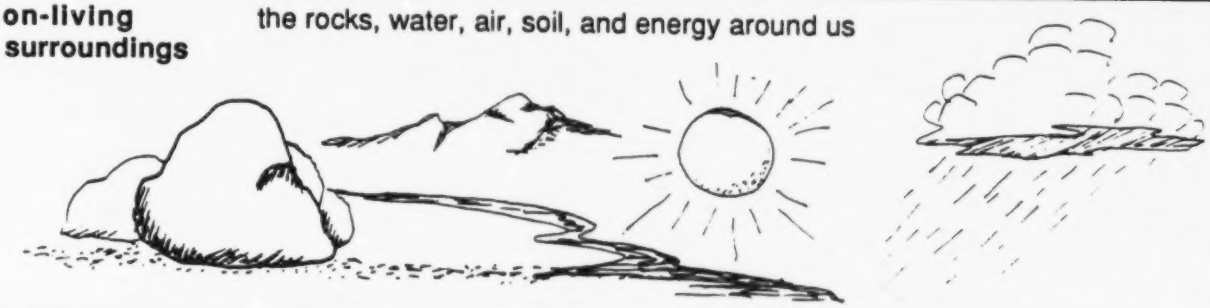
energy	the force that makes things move
food	energy and minerals in a form living things can use
food chain	the path of energy and minerals from the non-living surroundings to producers through consumers and back to the non-living surroundings.



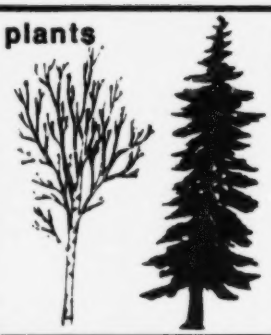
food web all the different food chains of an ecosystem



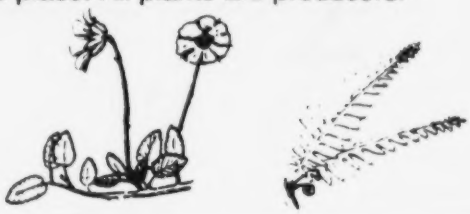
fungi one of the 5 great groups of living things. Most fungi do not move around but live their lives in one place. Most eat dead things and waste materials. Many fungi are white, but some are brown, green, red, yellow, or black.

herbivore	a living thing that eats producers (such as plants or algae)
interdependent	needing each other
living thing	something that is able to move, grow, and make new things like itself
microscopic	too tiny to see, unless you use a microscope
minerals	the substances that make up living and non-living things
monerans	one of the 5 great groups of living things; includes only microscopic things like bacteria and blue-green algae 
mutualism	an interaction between two kinds of living things from which both benefit
non-living surroundings	the rocks, water, air, soil, and energy around us 
omnivore	a living thing that eats both producers and consumers
organism	a living thing
oxygen	a gas that most living things breathe in and need in order to live
parasitism	an interaction between two kinds of living things from which one benefits and the other is harmed.
photosynthesis	the way that plants and algae change sunlight, water, and carbon dioxide are changed into food

plants



one of the 5 great groups of living things; includes all the living things that have leaves, roots, and stems. Nearly all plants are green and live their lives without moving from place to place. All plants are producers.



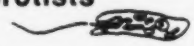
pollination

carrying pollen (small yellow grains) from one flower to another; needed by many plants in order to make seeds.

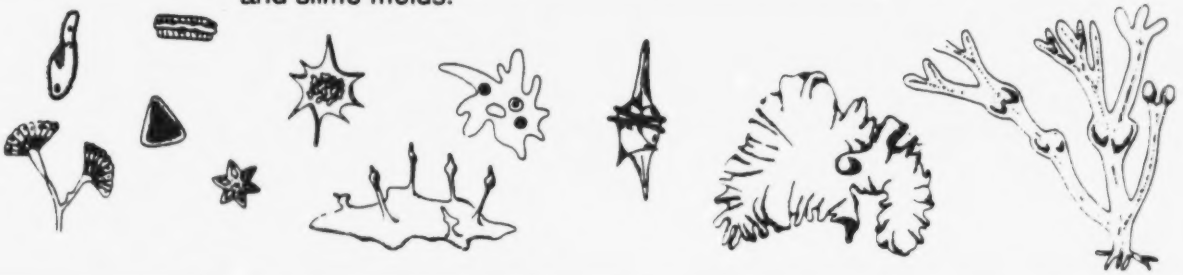
producer

any living thing that makes its own food; plants and algae are both producers

protists



one of the 5 great groups of living things. This group includes some microscopic living things called protozoans, and algae, seaweeds, and slime molds.

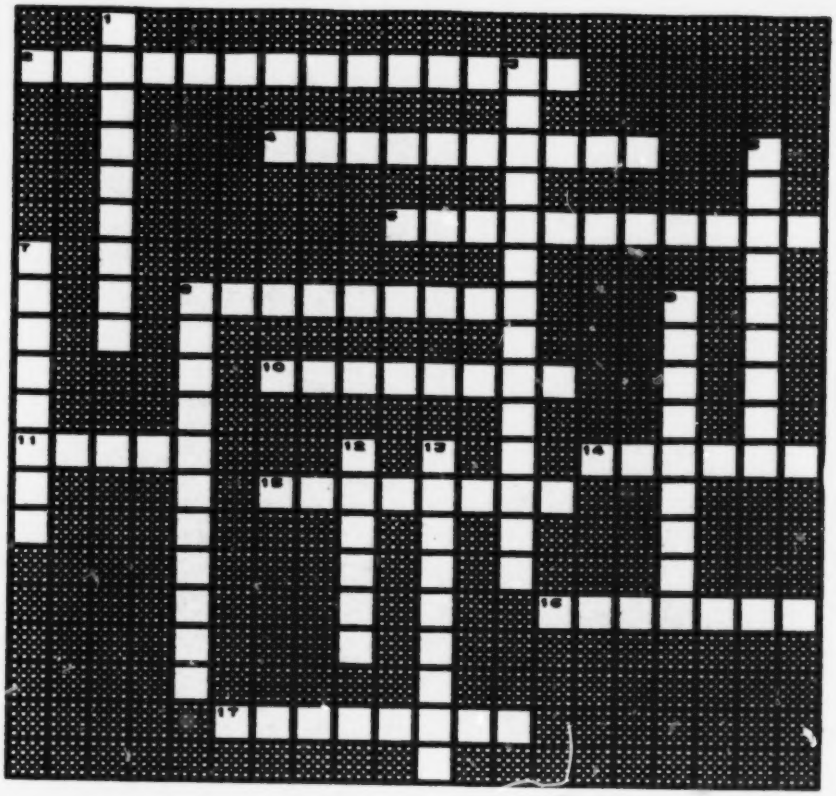


symbiosis

living together; when two organisms live in close association

ECOLOGY CROSSWORD

Name _____



ACROSS CLUES

2. the way that plants and algae use sunlight to change water and carbon dioxide into food and oxygen
4. an association between two living things where one benefits at the expense of the other
6. a living thing that eats wastes and things that have died
8. a living thing that eats living animals or other consumers
10. a living thing that gets energy and minerals directly from its non-living surroundings
11. a type of living thing, similar to plants but without roots or leaves. May be green, yellow, brown, or red
14. a gas that most living things breathe in and need in order to live
15. a living thing that gets food by eating other living things
16. a group of living things that is mobile and gets food by eating other living things
17. a group of living things that includes protozoans, slime molds, and algae -- many of which are microscopic

DOWN CLUES

1. the path of energy and minerals from the non-living environment, to producers, through consumers, and back
3. needing each other
5. a living thing that eats producers
7. the building blocks of living and non-living things
8. the interaction between two kinds of living things that use the same limited resource
9. the non-living environment and all living things, and their interactions, in a specific area
12. the force that makes things move
13. an association between two kinds of living things where both benefit

Alaska Wildlife Week Unit 4. © ADF&G 1998

Lesson 1.

Students will recognize that ecosystems are made up of non-living and living things, and be able to differentiate and give examples of each of these.

Background. All ecosystems include the non-living surroundings and living things. The non-living surroundings include air, water, rocks, dirt, and sunlight (and energy in other forms, such as heat). Both living and non-living things are made up of the same things--elements and energy. Living things are differentiated from non-living things by their abilities to move, grow, and reproduce themselves. The two most familiar groups of living things include plants and animals. These were once considered the only groups of living organisms, but many living things did not really fit into either of these groups. So, today, scientists classify living things into 5 different groups, or kingdoms. The 5 "great groups" of living things (listed on page 55 and shown on the "Living Things" poster) are easy to learn. Elementary students should learn to recognize the groups, and representatives of each, as all are important in ecosystems.

Vocabulary: *air, algae, animals, bacteria, ecosystem, energy, fungi, living, microscopic, non-living, plants, soil, rocks, water.*

Introductory Activity.

Objectives:

1. Students will practice listening, memory, visualization, and classification skills.
2. Students will be able to identify the living and non-living components of an ecosystem.

Materials:

Alaska Wildlife Week posters, photos of several natural areas

Procedure:

1. Most students spend a lot of time outdoors and may already be familiar with a variety of living and non-living things. This excercise will help them to think of the non-living and living things they are already familiar with and encourage them to look for additional kinds. Ask students to listen carefully, then imagine they are on a walk through a nearby natural area. Explain that you will read a few lines to get them thinking, but then they will continue their walks by visualizing things they might see (realistically). They are to write a list of the things they notice. Read the following passage aloud to the class.

What a beautiful day for a walk through an ecosystem. The sky is filled with big fluffy clouds. Still, the sun is shining through one big patch of blue. The sunshine feels warm on my coat, but the air is still a little chilly. Most of the winter snow has melted. The ground is wet and muddy. Perhaps I will be able to find some animal tracks. High overhead, a flock of geese honk wildly. They are heading north with the spring. I have the whole day to explore this ecosystem. I wonder what I will find....

2. Wait a few minutes. Ask students to name some of the things they visualized and listed. List each realistic item on the board. If students listened carefully, the list should include sunshine, clouds, water, snow, and geese. They may have visualized plants, animals, people, or other items. Prompt them to think of as many things as they can. Use a few of the items as examples of living and non-living things. Help students to figure out the differences between these.

3. Ask students if they remember the name of the place they are "walking" through., Do any students remember the word, "ecosystem"? Explain that anywhere they go on earth they will be in an ecosystem. Ecosystem is a word that describes all the living and non-living things that occur in an area. Use the Alaska Wildlife Week photo poster and the Non-living Surroundings, and Living Things posters to review with students the wide variety of living things that occur in ecosystems. How many of the organisms shown did students visualize on their ecosystem walk? Point out some of the organisms they didn't think of. Add to the list on the board any of these that students have seen, or think may occur in the ecosystem around your school. Then ask students to hold thumbs up for living things, and thumbs down for non-living things while you review the list of non-living and living thingson the blackboard.

4. Have students look at the Ecosystems poster and/or photos of several natural areas and find the similarities in the areas. What do all the ecosystems include? (Non-living things and living things). If at all possible, go outside (even if just in the school yard) and have students identify living and non-living things around them. Follow-up with other activities, the Secret Science Words, Living Things Bingo, and Living Things Worksheets.

Alaska Wildlife Week Unit 4, © 1985 ADF&G

SECRET SCIENCE WORDS

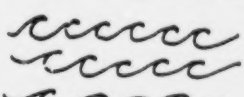
Name _____

_____

_____

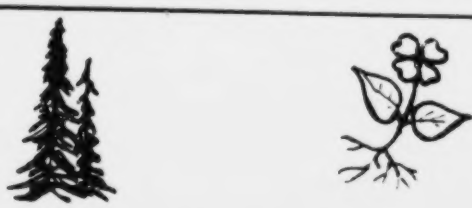
1,7 5,12 6,9

1,10 3,10 2,9 6,8 3,8 1,8 2,8 2,10



5,10 1,7 2,10 1,12 6,9

4,7 3,8 6,9 2,10



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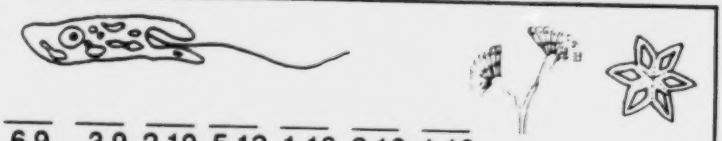

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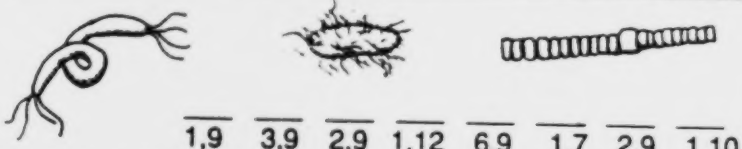
2,12 3,10 2,9 3,12 3,8



1,9 3,9 2,9 1,12 6,9 1,7 2,9 1,10

Break the secret code by matching the numbers to letters using the Code Breaker Key shown on the right. If the code says, 4, 9---- find the letter by finding where column 4 and row 9 meet---Did you find the letter p? Can you find 2, 11? If you found the letter z, you can to break the code! Find the secret words for all the living and non-living things that all together, make up an:

1,12 3,7 3,9 1,10 1,11 1,10 2,10 5,7 1,9

12	e	f	g	h	i	j
11	y	z	a	b	c	d
10	s	t	u	v	w	x
9	m	n	o	p	q	r
8	g	h	i	j	k	l
7	a	b	c	d	e	f
	1	2	3	4	5	6

Alaska Wildlife Week Unit 4. © ADF&G 1986

Activity Ideas for Curriculum Integration

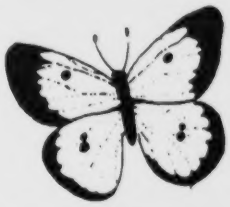
LANGUAGE ARTS ART SCIENCE

Objectives: Students will become more familiar with the non-living and living things that make up ecosystems and be able to classify them.

Materials: Old magazines and/or books that deal with science, nature, or wildlife; index cards; or xerox copies of the drawings on the poster.

Procedure: (This step may be done in class, as homework, or as preparation by the teacher) Have students go through the resource materials looking for photos of living and non-living things. Ask students to cut out pictures (or use the photos as references to draw pictures) of living and non-living things that occur in ecosystems. Each individual is to locate at least one picture of a non-living thing and a representative of each major group of living things, i.e. monerans, protists, fungi, plants, and animals. Have students draw (or paste) their pictures on to separate index cards. Each student should make 6 cards, with each card showing just one living or non-living thing. Have students write the name of the pictured item on each card.

Shuffle all the cards together. This game may be played in groups or individually. Explain that the object of the game is to get rid of all their cards. They do that by correctly classifying the item pictured. You will call out a category, non-living, or living thing--moneran, protist, fungi, plant, or animal. If a group has a card that fits the category, they hold it up. If their classification is correct, they may discard the card to a central pile. If their classification is wrong, they have to draw another card from the pile and they can't discard. First student or group to get rid of all their cards wins.



SOCIAL STUDIES

Objectives: Students will recognize that worldwide, ecosystems include the same kinds of non-living and living things.

Materials: Photos or slides of wild areas around the world.

Procedure: Show the photos to the class. Identify the locations where the photos were taken on a world map or globe. Then have students look carefully at all the photos. Have students compare the photos and decide what they have in common (air, water, soil, sun, plants, animals, etc.)? Students should eventually realize that the same kinds of living and non-living things are found all over the world. Have them guess whether or not they might find other similarities if they visited the areas. Would they all have insects? Microscopic living things? Fungi? (Representatives of the 5 kingdoms are found in nearly all inhabitable environments on earth.)

LANGUAGE ARTS SCIENCE

Objectives: Students will practice classification and recognition of the 5 major groups of living things.

Materials: Alaska Wildlife Week Living Things poster, one photocopy of the enclosed Living Things classification worksheet for each student in the class, plus one copy that is cut up, crayons or felt-tip markers, paste, construction paper, bingo markers (such as beans or pennies).

Procedure: Review the variety of living things using the Living Things poster. Give each student a copy of the Living things Classification Worksheet. Have them color in the organisms and cut up this sheet so that each pictured organism is on a separate piece of paper, and each of the 5 categories is on a separate square of paper. Then, have each student reconstruct their own unique bingo card by pasting all the headings on a sheet of construction paper in the order of their choice. Then have them classify and paste each of the pictured organisms under the proper category. They can use the poster to help figure out which category each organism should be placed in. When all the students are finished, each will have a unique bingo card. Pass out the bingo markers. Place the squares of the cut up bingo card in a jar and select one student to be a caller. The caller reaches into the jar and pulls out a card. They then decide which category it should be in and call out the category and the name of the organism. (Encourage the class to correct the caller if he/she classifys any organism incorrectly.) Students then place a marker over that organism on their card. Repeat until one student has 5 in a row (up, down, or diagonally). That student becomes the caller for a new round.

SCIENCE

Objectives: By visiting and examining a nearby outdoor site, students will recognize that their surroundings are an ecosystem that includes representatives of all the major groups of living things.

Materials: Paper and pencils; Ecosystem Investigation information (see pages 49-54); field equipment as described on each Ecosystem Investigation Sheet.

Procedure: You can use the information on the Ecosystem Investigation sheets to set up stations at an outdoor site near your school, or give them to students and have the students set up and do the suggested investigations. Review the sheets and select those that are appropriate for your area. Obtain or make the necessary equipment. If you are setting up stations, do so the morning or day before the class period.

1. In class-- Review the variety of living things using the poster. Ask students how many of the different kinds of living things they thinkoccur in your area? Discuss each kingdom--monerans, protists, fungi, plants, and animals separately. Have students guess whether or not they could find these organisms in their area; how many different kinds of organisms (from each group)occur, (if any); and which kinds are the most and least abundant.

Then, challenge students to try to find out how accurate their guesses were. What living things really do occur in your area? What would be the best way to find out what is out there? Go out and look!

Divide the class into groups and have each group make an ecosystem booklet based on their observations and studies of a nearby outdoor area. Each booklet should have at least 6 pages, one on the non-living environment of the site, and one for each kingdom of living things. Students can use copies of the Ecosystem Investigation Worksheet for the pages on living things. Each group should record all their observations of living things on the appropriate pages of their book. Their records should labeled drawings, and measures of abundance. Encourage students to use field guides to try to identify some of the living things that they find.

If students will set up their own studies, have them read the Ecosystem Investigation sheets and prepare before going out on the field trip. If you have set up stations, they can just read the directions at each station. Before or after the field trip, students may want to talk to microbiologists about how to find monerans and protists, or talk to a wildlife biologist about reading animal sign, or setting small animal live traps. Or they may want to read books about the various organisms, what they do, where they live, etc. and try to figure out to how to look for them.

After the field trip, discuss how the list of living things discovered by the class compares to the list of living things they expected-- in numbers, variety, and abundances? Are they surprised by anything? (Optional: Calculate the abundances of some of the organisms based on student measurements. Standardize the unit area measurement to" number / sq meter" (or other).

Suggested Evaluation: Have students write an essay to tell others about the living things of your area. Do they write about all the different groups of living things?

SCIENCE

Objectives: Students will be able to identify some of the differences between living and non-living things, and describe some experiments to determine whether an object is living or not.

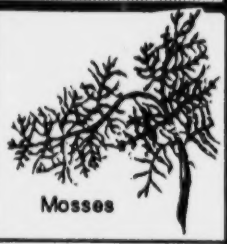
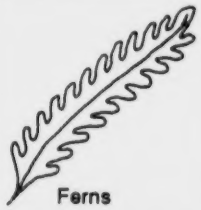
Materials: A variety of living and non-living things: a jar of water, a jar of air, soil, a rock, a ray of sunlight (if possible), a wind-up toy, a group of rocks-2 large and several small, sugar crystals (a jar of water with sugar dissolved in it and a string--allow to set for a day prior to class) a small bird or mammal, several different live insects and/or other invertebrates (such as flat worms, a clam, or other), microscopic organisms, yeast, bread mold, spores from a fern or mushroom, and some kind of plant seeds. Try to include at least some small living things with which your students are not familiar. Provide students with microscopes, hand lenses, and other equipment as available.

Procedure: The purpose of this activity is to reinforce student knowledge of the differences and similarities between living and non-living things, but more importantly to encourage them to think and question by providing examples of items that are not easily classified. Place the above materials at different numbered stations around the room. Discuss and review the differences between living and non-living things (abilities to respond to stimuli, move, change, and reproduce). Then explain that students are to imagine themselves as scientists from another planet; their explorers brought back the items that are around the room from the planet Earth. As scientists, they are to determine which of the objects, if any, are living and which are non-living. They must describe the tests they conducted to determine which items were alive. They may also conclude that further tests are needed--but they should then describe what further tests they want to conduct.

Have students work in groups or individually. After they have time to visit each station, have the" scientists" report their conclusions regarding each item. Record the class votes for living and non-living for each item. Select individual students to explain why their group classified the item as living or non-living. What tests did they conduct and what were the results? Encourage students to think of other tests they might conduct to better determine the classification of the items. If necessary, prompt students to think ofobserving the questionable objects over time to see if they grow, change, or reproduce. Leave the stations set up so students can compare the items over time. Do further observations change any opinions about the classification of the various items? In the end, reveal the actual classification of the items, and discuss any discrepancies between the class conclusions and the facts. You may want to grow the seeds and the spores to prove they are alive, but needed to be placed in the proper environment in order to grow.

Extension--Have interested students do an extra credit report on the tests done by scientists to find out whether there was life on the moon or on Mars. If possible, have them present their findings as an oral report to the class.

LIVING THINGS BINGO

MONERANS	PROTISTS	FUNGI	PLANTS	ANIMALS
Blue-green Algae (Cyanobacteria)	Algae	Mushrooms	 Mosses	Arthropods
Spirochete Bacteria	Slime Molds	Morel	 Ferns	Mammals
Rod-shaped bacteria	Phytoplankton	Lichens	Horsetails	Birds
Filamentous Bacteria	Seaweeds or Kelp	Shelf Fungi	Conifers	Fish
Bacteria	Protozoans	Molds	Angiosperms	Worms

Living Things Worksheet

Name _____

_____

21 + 3 =____

_____

6 x 6 =____

_____

81 ÷ 9 = ____

_____

6 x 8 = ____

_____

45 ÷ 5 = _____

_____

6 x 7 = ____

_____

12 ÷ 4 =____

_____

42 ÷ 7 =_____

_____

9 x 6 = _____

_____

24 ÷ 4 = ____

_____

7 x 9 =_____

_____

64 ÷ 8 = _____

Circle the non-living things and color the living things. Then, do the math problems to check your answers. If the answer is equal to 3 or 9, the picture shows something non-living. Otherwise, the picture is of some living thing. The code below will tell you which Kingdom of living things each organism belongs to. Write the name of the correct Kingdom under each picture.

7, 8 or 9 = Animal 42 or 54 = Plant 36 = Moneran 6 or 48 = Fungi 3 or 63 = Protist

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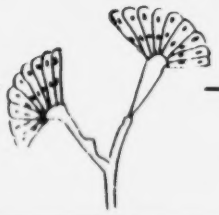
Lesson 2.



—Upper Elementary

Students will be able to explain that plants and algaeget energy and minerals from their non-living surroundings.

Background. Like all other living things, plants and algae need minerals and energy. But in contrast to other living things, plants and algae do not eat other living things; they are not consumers. Instead, they are called producers, because they can use minerals and energy from the non-living surroundings to make or produce their own food. Plants and algae store energy from sunlight by a process called photosynthesis. Photosynthesis is simply the change of carbon dioxide (from the air), water, and sunlight (energy) into sugar--(or stored energy) and oxygen. Plants make their tissues (leaves, flowers, stems, roots) by combining the sugar (stored energy) produced by photosynthesis with minerals from the soil. Algae make their cells by combining the sugar produced by photosynthesis with minerals that are dissolved in water.

All ecosystems include producers--living things that are able to make food by using minerals and energy from then non-living environment. Plants are the main producers in forest and tundra ecosystems, while algae (includes seaweeds) are the main producers in ocean ecosystems. Producers, (plants, algae, and certain monerans) are critically important for the survival of all life on earth, because they change energy and minerals from the non-living surroundings into forms that other living things can use. They are also critically important because they remove carbon dioxide from the air, and replace it with oxygen--the gas that nearly all living things must breathe in order to use the energy and minerals in their foods.

Vocabulary: *algae, carbon dioxide, energy, food, minerals, oxygen, photosynthesis, producer, plants, soil, water.*

Introductory Activity.

Objectives:

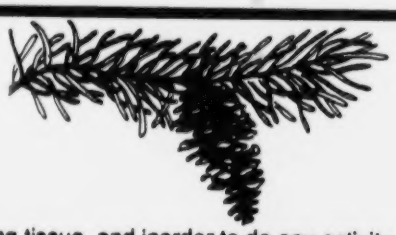
1. Students will be able to explain that plants get the energy and minerals they need from the non-living surroundings.

Materials:

A plant, the bulletin board from Lesson 2 Introductory Activity, but add a column heading "Makes Food from Non-living Things" (Producers). Also, the sunlight, water, carbon dioxide cards from this packet (p. 19-20), cards that represent other minerals, a balloon (blown up) labeled "air" attached to a table, a large construction paper cut-out of the sun, a pitcher of water (or a picture), and a magazine picture or drawing of soil on a bulletin board (or around the plant pot), each of these visual aides should have a paper cup stapled or taped up beside them. Put the carbon dioxide / oxygen cards on the table (some with the carbon dioxide side up and some with the oxygen side up) . Place the other cards in the appropriate cups.

Procedure:

1. Discuss the fact that all living things need two things in order to live--minerals and energy. Our bodies are made of the molecules in minerals. We need energy in order to rearrange these molecule



into living tissue, and inorder to do any activity (from breathing to running). Do students know where we get the minerals and energy we need to live? Explain that we get some minerals by breathing, but we get most of our minerals and all our energy by eating food. Set a potted plant (and/or an algae or seaweed) on a table in front of the class. Ask students to watch the plant for a little while. Then ask them if it is a living thing. What do they think the plant is doing. Does it move? Eat? Breathe? Grow?

Have the class act like plants. They are to just sit in the sunlight with their roots in the soil. (Or, have them act like algae--floating on the sea) Let them act out for just a minute or two, then ask how long they could really do that before getting hungry. One hour? One day? How do plants and algae do that without getting hungry? Do they eat anything? Can students figure out that plants must get energy and minerals some other way.

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2. Explain that plants and algae are able to do something that most living things can not do--they can get energy and minerals from the non-living surroundings and make food for themselves. Review the parts of the non-living environment using the display. Explain that sunlight is really a kind of energy, and that soil, water, and the air each have certain minerals in them. Plants are able to get some minerals (carbon dioxide) out of the air, and they get other minerals (including water) out of soil and water with their roots. Algae get all the minerals they need from the water. And, by a special process, called photosynthesis, plants are able to capture the energy of sunlight. Plants and algae are called producers because they produce their own food.

3. Demonstrate the process of photosynthesis by picking up the appropriate cards from the table (carbon dioxide) and from the labeled cups (water and sunlight) as you explain: The plant takes carbon dioxide from the air, and its roots get water from the soil. The plant or algae then catches a ray of sunshine and mixes these together to get stored energy and oxygen. Turn the cards over to show that the cards together spell these words.

3. Have each student come to the front of the room and act like a plant by "doing" photosynthesis. Have each student pick up the cards that show the things a plant (or algae) needs to make food, then turn the cards over to spell "Stored Energy and Oxygen."

4. Now discuss what the plant (or algae) does with the food and oxygen that it made. Explain that the plants put the oxygen into the air, where other living things can use it. Then they use the stored energy, along with minerals from the soil, in the same ways that other living things use the food they eat--to grow, move, and reproduce (make seeds).

5. Next, have everyone hold their breaths. Discuss how long they were able to do this. Why did they have to stop and breathe? Explain that most living things need oxygen, the gas producers make when they do photosynthesis, in order to use the energy and minerals in their foods. They need oxygen to do something called respiration--which is the opposite of photosynthesis. (Demonstrate by turning over stored energy and oxygen cards back into water, carbon dioxide, energy). Explain that too much carbon dioxide is poisonous to animals, and some other living things; most living things have to have oxygen in order to survive.

6. Spread all the cards out on the table so that the stored energy and oxygen sides are showing. Explain that the table represents an ecosystem. Reiterate that nearly all living things must eat (stored energy) and breathe in oxygen (for respiration). They then breathe out carbon dioxide, and give off waste water. Ask for volunteers to come up to represent living things. Explain that these students will pretend they are eating and breathing (as all living things do), by picking up stored energy/oxygen cards and turning them over, into carbon dioxide. Each player can continue playing as long as they can get stored energy (food) to eat and oxygen to breathe, but if they don't get any they will die and be out of the game. Help the class guess what will happen to the players. Will they run out of food? Out of oxygen? Allow the actors to "eat and breathe" and find out. (They will run out of both food and oxygen, and the air will be filled with too much carbon dioxide for them to survive).

6. Remind students that plants and algae are very special because they can do photosynthesis--something that very few other living things can. They take carbon dioxide out of the air and put back oxygen, and they "produce" stored energy and minerals--i.e. food. Ask for more volunteers to act like plants and algae in the game. On each turn, plant and algae players will pick up water, energy, and carbon dioxide cards and turn these over to make oxygen and stored energy. Now, can students predict what will happen when they replay the game with players who are plants and algae, and players who are other living things? Replay to test their hypothesis. (The other living things won't run out of food and oxygen because the producers will keep making more).

7. Follow-up with the We All Need Producers Worksheet, p. 21.

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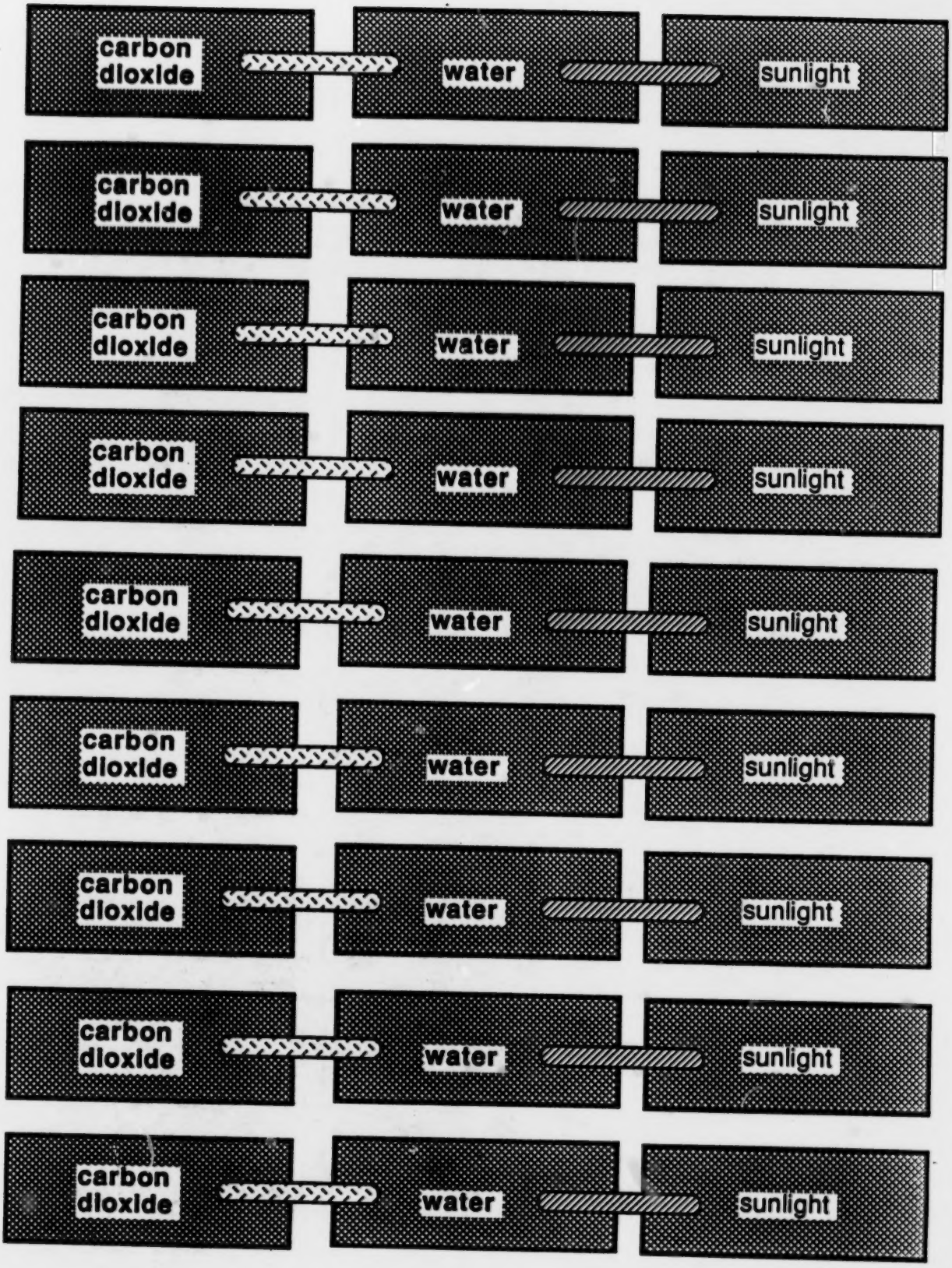
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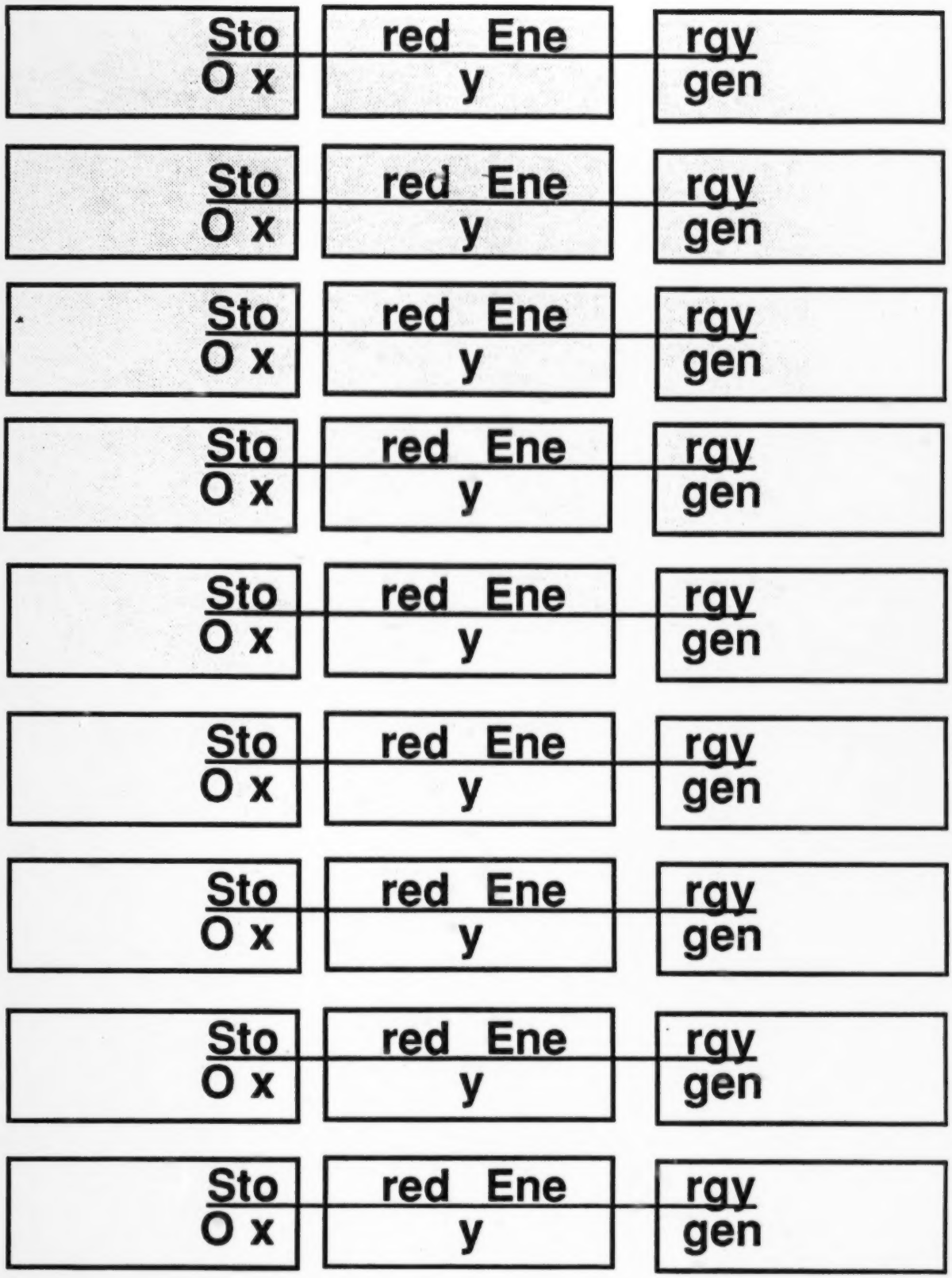
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Consumers Need Help

Name_____

Help! These animals don't have any any food to eat or any oxygen to breathe. Please draw in something to help them.

Alaska Wildlife Week Unit 4. © 1986 ADF&G

Activity Ideas for Curriculum Integration

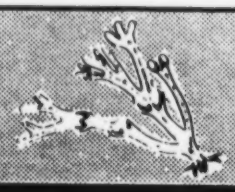
SOCIAL STUDIES ART MATH

Objectives: Students will become more aware of their surroundings and the importance of producers.

Materials: Photos of a variety of indoor and outdoor settings with (suburban, rural, forests, tundra, wetlands) and without plants (cities, parking lots, icefields, sand dunes, the moon's surface). (Optional: a room with lots of plants and a room without any plants), crayons, and newsprint or butcher paper.

Procedure: Show the class the various photos of outdoor settings and have students choose the 2 or 3 places they would most like to live. Hold each photo up and ask all those who chose it as one of their favorites, to raise their hand. Write the number of students choosing each place on a card next to the photo. Repeat for the indoor photos. Then separate the photos into the ones with many plants and those with few or none. (You may want to have 4 groups--indoors-- with and without plants, and outdoors-with and without plants.) Have students add up the number of votes for the photos with plants and the number for places without plants. Is there any difference? Why might students choose the ones with plants? Next, ask students which outdoor photos show places that an animal (use a specific example) might like to live. Why might most animals prefer to live in places with many plants? (Because they get food and shelter from plants, and because other living things they eat or depend on are more likely to live in such an area.

Finish up by having students draw a picture of an outdoor place where they would like to live. Do they show plants in their drawings?



ART

Objectives: Students will observe plants or seaweed closely and make posters that show their appreciation of these ecosystem producers.

Materials: Crayons, newsprint or butcher paper, access to the outdoors or a variety of plants from your area.

Procedure: Explain to students that not everyone realizes how important producers--plants and algae--are, so the class is going to make posters tol tell other people about producers. (Individual students may each make a poster, or you can have groups or the whole class work on giant banners. You may want to have one group work on algae and seaweed, and another on plants.) If possible, get students outdoors where they can look at plants and/or algae first hand and make sketches or crayon etchings for their poster. Encourage them to show the variety of plants that occur in the ecosystem on their poster. Have each student complete the sentence "Plants (Algae) are important because..." . Then, have them add the sentence to their posters as a caption.

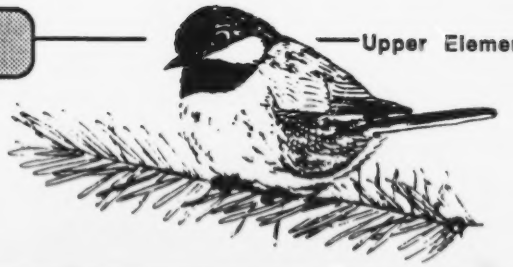
SOCIAL STUDIES

Objectives: Students will recognize the importance of plants to people.

Materials: (Optional--photos of food from magazines.)

Procedure: Ask students to name the things they like to eat for meals and snacks, or take an imaginary trip to the grocery store and make a list of the foods in the store. Or, use the photos of food from magazines. Discuss what each food item is, or is made from . How many are plant parts (fruits, vegetables, nuts)? How many are made mainly from plants (bread, cake, etc.)? Of the foods that are not plants or made directly from plants, how many are from animals that eat plants? How many are from animals that eat other animals? What do the prey animals eat? (Plants). Students should eventually realize that ultimately, all food for people comes from plants too. (Have the class make cookies, or bread, and trace out where each of the main ingrediants comes from.)

Discuss other ways that plants are important to people. Are any plants used to make things? (wood, rubber). Do students enjoy seeing trees, grasses, flowers? What effects do plants have on air quality? (One study showed that an acre of forest removes nearly 1 ton of dust from the atmosphere each year.)



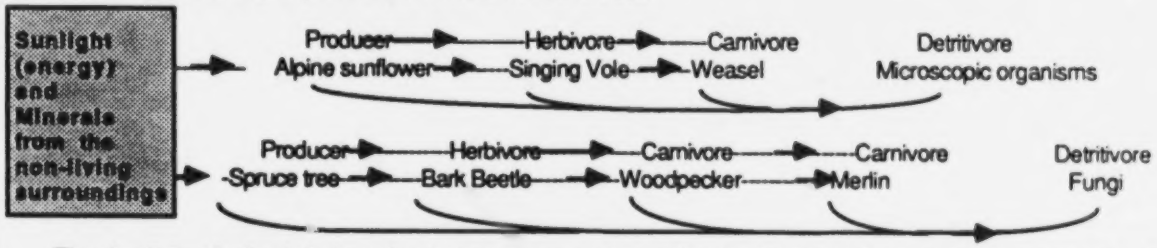
Students will understand that the energy and minerals in food made by plants is passed between animals through food chains and webs.

Background. All living things need energy and minerals to survive. Energy and minerals are exchanged in ecosystems through food chains and webs. Living things that are able to get energy from sunlight and minerals from the soil (or dissolved in water), like plants and algae, are called producers. These form the first link in food chains. All living things use some of the energy in their foods--to grow, move, ward off predators, respond to the environment, and produce young. Energy that is used is turned into heat and can not be reused by another organism. But every living thing also stores some energy, and minerals in its body, and loses some energy and minerals in waste materials. Thus the body and waste materials of all living things are potential foods for other organisms.

Living things that get their energy and minerals by eating other living things (or their wastes) are called consumers. The consumers that form the second link in a food chain are those that eat mainly producers (plants or algae). Dall sheep, singing voles, butterflies, mosquito larvae, and other living things that eat producers are called herbivores. Consumers that eat mainly herbivores are the next food chain link. They are called carnivores, which means flesh-eaters. Phalaropes, weasels, and seals are examples of carnivores. Some food chains also include carnivores that eat other carnivores (called 2nd order carnivores). Some food chains also include omnivores, living things that eat both producers and consumers.

Detritivores, or decomposers, are organisms that get energy and minerals from eating waste materials and dead organisms. Fungi, slime molds, many insects, and many microscopic organisms (such as bacteria) are detritivores. Bald eagles, crabs, ravens, and other large animals that scavenge dead animals are also detritivores. They form links with every other food chain link, because they eat waste and dead material from producers, herbivores, and carnivores. Detritivores are very important, because they break down waste materials and dead things into minerals, water, and carbon dioxide--the raw materials that plants need to store more energy from the sun and make new food. Without detritivores, these raw materials would soon be stored in dead organisms, and plants would be unable to continue producing oxygen and new food.

Here are two examples of food chains that occur in Alaskan ecosystems. Most of the organisms in both are shown on the 1986 Alaska Wildlife Week poster. The detritivore links are often not shown in examples of food chains, but they are very important and should not be left out.



The simplicity of a food chain makes it an easy concept to understand. The exchange of energy and minerals through food chains is not really that simple however. Most living things eat a variety of things. Most herbivores eat a variety of plants; most carnivores eat a variety of other consumers. A better picture of the exchange of energy and minerals in ecosystems is a food web that shows connections between all the living things that eat each other.

Vocabulary: *carnivore, consumer, detritivore, energy, food, food chain, food web, herbivore, omnivore*

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Introductory Activity.

Objectives:

1. Students will learn that the energy and minerals in food made by plants are passed between other living things through food chains and webs by playing a food chain game.

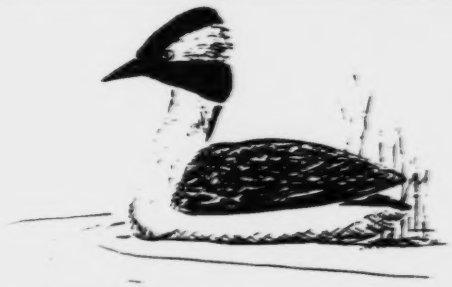
Materials:

Alaskan Examples of Food Chains and Webs, p. 56, name tags for students that say "Producer", "Herbivore", "Carnivore", "Omnivore," and "Detritivore"; Energy and Minerals Cards-- photocopy from p. 25; references on wildlife.

Procedure:

1. Ask students to name as many living things of your area as they can. Prompt them as necessary to come up with representatives of at least the following groups: plants, birds, mammals, insects, fungi, and microscopic living things. Write the names of the living things on one side of the blackboard as they are called out. Now, write "makes its own food", eats mainly plants", "eats mainly meat", and "eats mainly dead things and waste materials", "eats all kinds of things" as separate headings across the top of the remaining blackboard. Start at the top of the list of living things and help students move each living thing to the correct category. Where possible, have students look up the answers if they don't know what something eats. (See the back of the poster, the Food Chain Background Information-p. 56, and the Alaska Wildlife Notebook Series (should be in your school library).

2. Explain that all living things need energy and minerals to live, grow, move, and reproduce. Have the class discuss how each of the groups of living things on the blackboard get the energy and minerals they need to live. Draw in the sun and soil to show where producers get their energy and minerals. Then draw arrows to show that plant-eating animals get their energy and minerals from plants, meat-eating animals get theirs from plant-eating animals, and those that eat everything, or dead things and waste materials get energy and minerals from plants, plant-eaters, and meat-eaters. Review the vocabulary terms for these groups--herbivore, carnivore, omnivore, detritivore. Select out (or have students select) specific living things on the lists that actually eat each other to make 2 or 3 examples of food chains. Explain that



the exchange of energy from the non-living environment to plants through other living things is called a food chain.

3. The following Food Chain Game is to show students how energy and minerals are exchanged in an ecosystem. Divide the class into the following players, producers (15), herbivores (6), carnivores (2), omnivores (2), and detritivores (5). (Use similar ratios for smaller classes). Give each student a name tag that shows what kind of living thing they are. The object of the game is to pass energy and minerals through the ecosystem. The only players who can survive are those who can get food on every turn.

You, the teacher will represent the sun and continually toss out energy cards. Be sure to have a big supply (90) of these.

Spread the minerals cards and paperclips around the area where students will play. Each kind of player has separate rules:

PRODUCERS--These players, representing algae and plants are to stay in one spot (they are rooted to the ground!). They can lean over and reach out to get energy and minerals cards and paperclips. They can only pick up these materials if they are separate. They can not pick up any energy cards that have check marks on them. On each turn, producer players pick up an energy and a minerals card, then paperclip them together (photosynthesis) to make an "energy sandwich." They must make 2 sandwiches per turn. It takes energy to make food--so producers have to check off one square on each energy card they pick up. After checking off the energy card, producer players must keep one sandwich, and toss the other to the floor as waste.

HERBIVORES-- On each turn, the herbivores must get 2 sandwiches from the producers. They check off 1 square on each energy card to show that they used some energy.

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CARNIVORES-- They behave the same as herbivores, except they get their food sandwiches from the herbivores instead of from producers. They check off one square on the energy card.

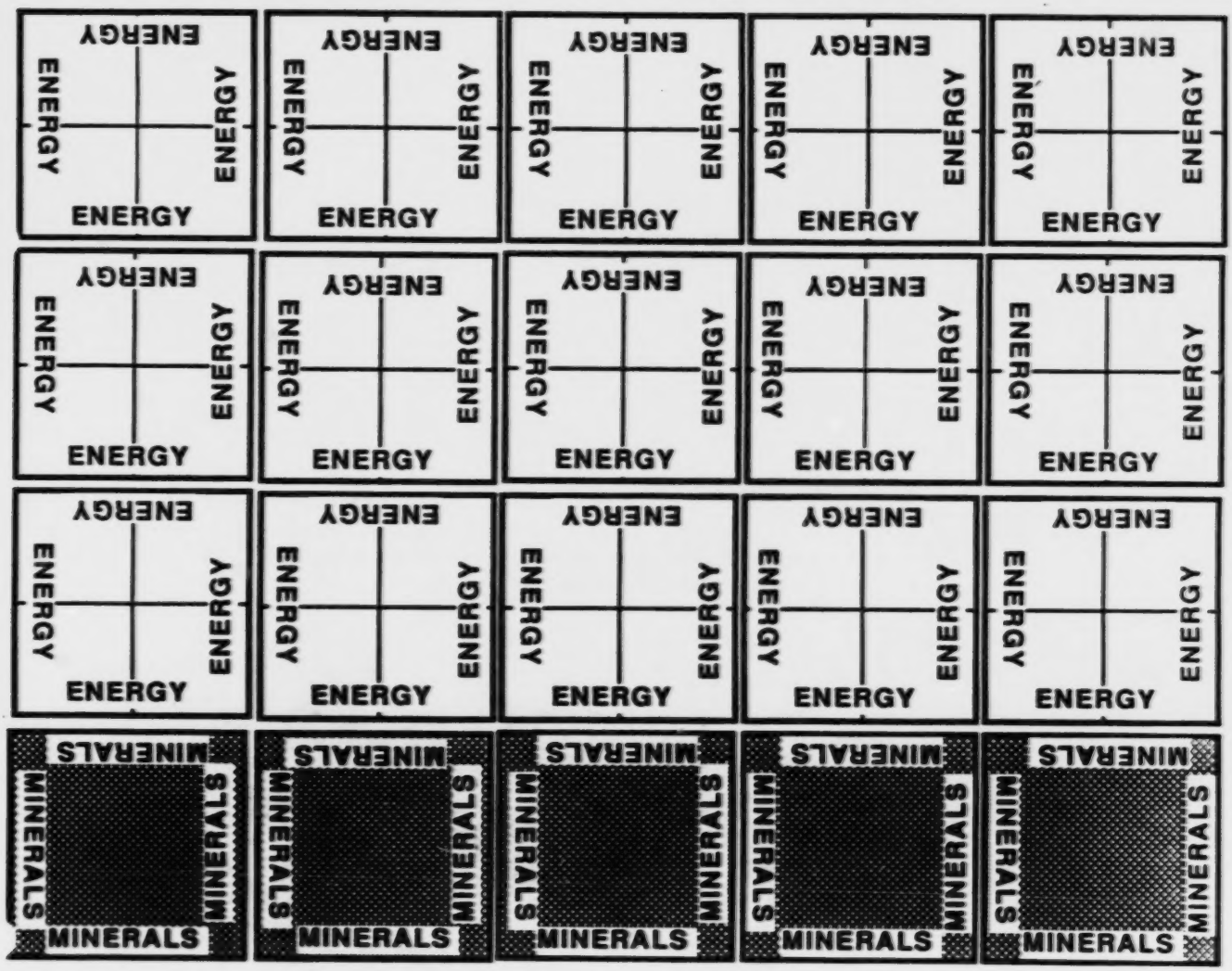
DETRITIVORES– These players pick up the wastes, the sandwiches on the floor. They must pick up 2 per turn, then check off one square on each energy card. When discarding the sandwich at the end of each turn, detritivores must look carefully at the number of checks on the energy card. If the energy card is filled with 4 checks, thedetritivores remove the paper clip before discarding that sandwich. Thus they return the minerals to the "soil". If the checks do not fill up the square--they put the whole sandwich back down on the floor where another detritivore can pick it up.

You will call out turns--on each turn each player must get two sandwiches. Any player who doesn't find food dies. Then, those that survived toss one of their sandwiches to the floor. Then play another turn. Repeat for many turns so that students can see that everyone continues to get food.

After playing the game for a while, have every student choose what kind of living thing they want to be and get a name tag--or assign students in order to try different variations. What happens if everyone is a carnivore? (They all starve.) What if there are no detritivores? (The producers run out of minerals, and can't make anymore food--all the organisms starve.) Do students understand how energy and minerals are passed through the ecosystem?

FOLLOW-UP this lesson with the Food Chain Worksheet p.26, Ecosystem Maze Worksheet p.27, and some of the Curriculum Integration Activities. p 28-30 .

ENERGY AND MINERALS CARDS Photocopy and cut up 6 sets of cards (for a class of 30) to make 90 energy cards and 30 minerals cards. Laminate and use washable markers so that energy cards can be re-used.



FOOD CHAIN WORKSHEET

Color the producer cards green, the herbivore cards yellow, the carnivore cards red, and the detritivore cards blue. Then, cut the cards out, find the 4 food chains, and paste the food chains onto another sheet of paper. Write your name on your food chain paper.

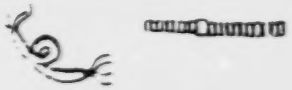
This is a diatom. It photosynthesizes its food.

This is a copepod. It eats diatoms.

This is a Dall's sheep. It eats low-growing alpine plants, like alpine avens.

This is a grebe. It eats small fish, like sticklebacks.

This is a raven. It feeds on dead animals.



This is a bacteria. It feeds on dead plants and animals and waste materials.

This is a herring. It feeds on zooplankton, such as copepods.

This is a redpoll. It eats the seeds of willows and other shrubs.

This is a harbor seal. It eats ocean fish, like herring.

This is a merlin. It eats small birds.

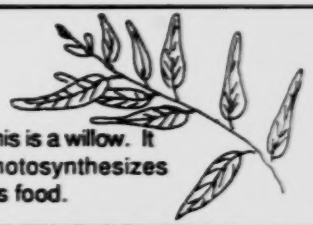
This is an alpine avens. It photosynthesizes its food.

This is protist, called green algae. It photosynthesizes its food.

This is a mosquito larvae. It eats protists, such as algae.

This is a 3-spine stickleback. It eats aquatic insects, like dragonfly larvae.

This is a Pholiotus mushroom. It gives off chemicals that digest dead plants and wastes. Then it soaks up the digested material.



This is a willow. It photosynthesizes its food.

This is a crab. It eats dead things and waste material on the ocean floor.

This is a killer whale. It eats fish, and sometimes seals.

This is a dragonfly larvae. It eats the aquatic larvae of other insects, such as mosquitos.

This is a wolf. It eats moose, caribou, and sheep, especially young animals.

This is a fox. It eats just about anything it can catch, including small mammals, small birds, and bird eggs.

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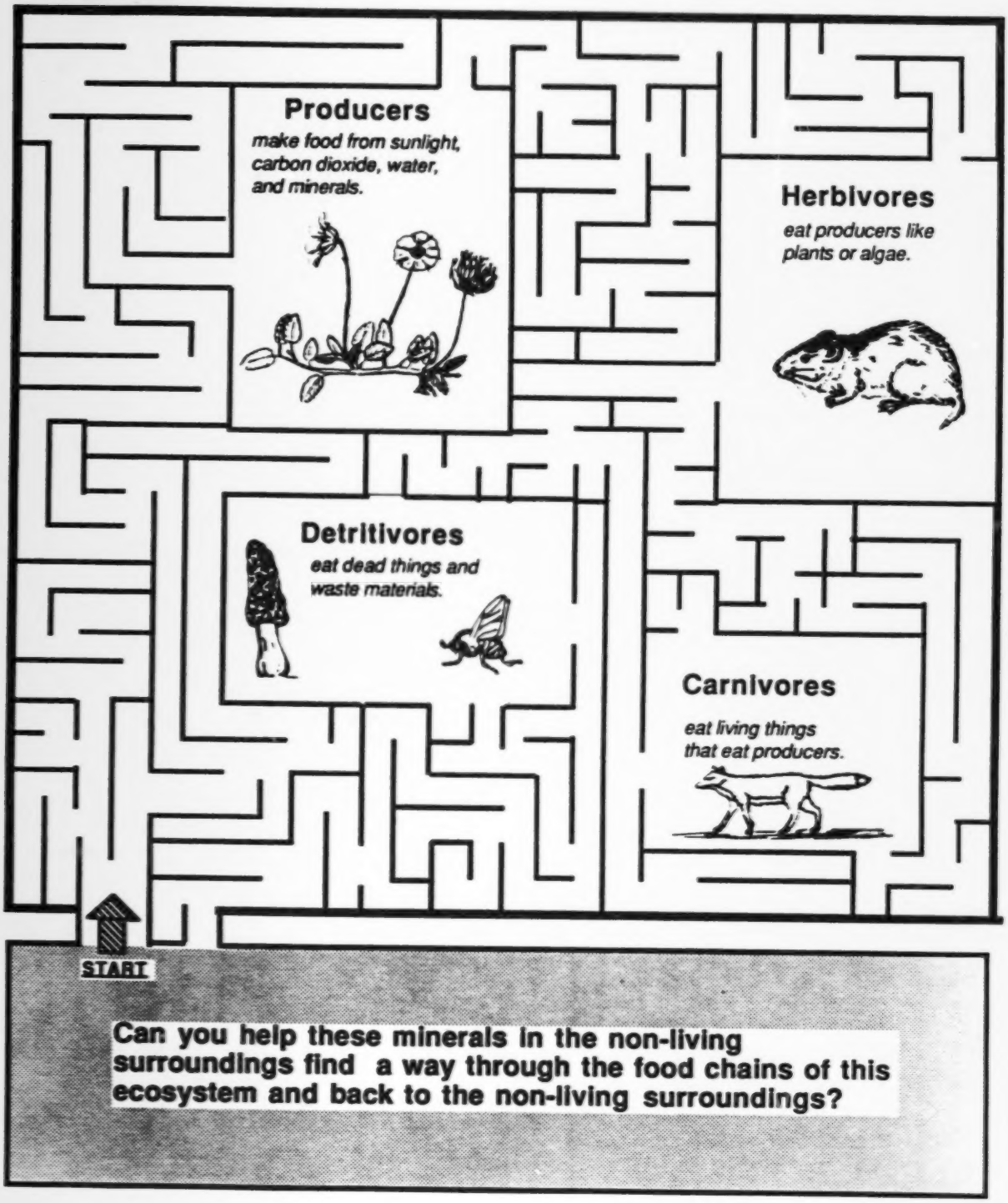
Ecosystem Maze

Name_____



Can you help these minerals in the non-living surroundings find a way through the food chains of this ecosystem and back to the non-living surroundings?

Alaska Wildlife Week Unit 4. © 1996 ADF&G

Language Arts

Objectives: Students will strengthen their understanding of the food chain concept by writing and acting out a food chain story.

Materials: Reference materials on wildlife.

Procedure: Write the following up on the blackboard:

This is the sun that sent the energy, and this is the soil (or water) that had the minerals.

This is the "producer" that made the food by using the minerals from the soil and catching the energy from the sun.

This is the "herbivore" that ate the "producer" that made the food by using the minerals from the soil and catching the energy from the sun.

This is the "carnivore" that ate the "herbivore" that ate the "producer" that made the food by using the minerals from the soil and catching the energy from the sun.

This is the "detritivore" that returned the minerals to the soil, by eating all the waste materials. So, that is our food chain story. The soil once more has minerals and the sun is shining down, so here are the producers, herbivores, carnivores and detritivores--ready to start again.

Divide the class into groups of 5 or more students. This activity can be done in two ways depending on your students' abilities. You may have students invent their own food chains, using reference materials to figure out what various living things eat. Or, provide each group with the living things that make up a food chain, then have them decide what order they fit into the story. If necessary you can also supply the information on what each living thing eats. (See pages 47-48).

Once students have selected the living things in their food chain, they should figure out how to act out each line in their story. For example, to show the sun they may hold their arms over their heads. To act out a wolf, they may want to show their teeth, or howl. Once the groups have their stories ready, have them present them to the class as a skit. The story can be narrated by one of the group members or by you, if necessary. Students may replace the terms (producer, herbivore, carnivore and detritivore, with the names of the living things they chose--or leave the terms in and have the class try to guess the living things in their food chain story.

SCIENCE

Objectives: Students will practice drawing and reading skills and demonstrate an understanding of the food chain and food web concept by making food chains and a food web for your area.

Materials: Alaskan Examples of Food Chains and Webs (p. 56),photocopies of the Make a Link Worksheet (p. 30) for each student, references on wildlife (optional), crayons or felt-tip pens,scissors, stapler, construction paper.

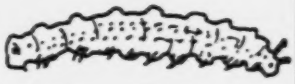
Procedure: Select examples of food chains from one of the four ecosystem examples (forest, wetland, tundra, and ocean). Divide the class into groups (optional) and give each group a list of the organisms in one food chain. You may give them the answers to the questions on the worksheet, or have them do some library research to find the answers. Have students go to the library to find pictures and/or information about the living things they were assigned. (Most are pictured on the Alaska Wildlife Week Photo Poster, or the Ecosystem and Living Things posters in this packet; See also, the posters from previous Alaska Wildlife Week packets (1983-1985) or the Alaska Wildlife Notebook Series (both should be in your school library). Have students hand in their drawings to be sure they found or wrote in the correct information about their living thing.

Then have students cut out the chain link, and paste the information about the organism on the back. Have each group make their links into a food chain by connecting the links with loops of construction paper and staples. Then lay all the chains out on the floor, information side up. Have students look for other links to make a food web. They'll need to make the connections between the food chains using chains of construction paper loops (so the web will lie flat). Hang the food web up on the ceiling, or on a wall so that the pictures are facing the viewer. Students should see all the connections of the food web. (You can tug on any one organism and see how many other links move. Or, have students represent the organisms and use yarn or string to show the interconnections.) (Idea contributed by Linda Frame, Palmer).

Food Chain Worksheet

Name_____

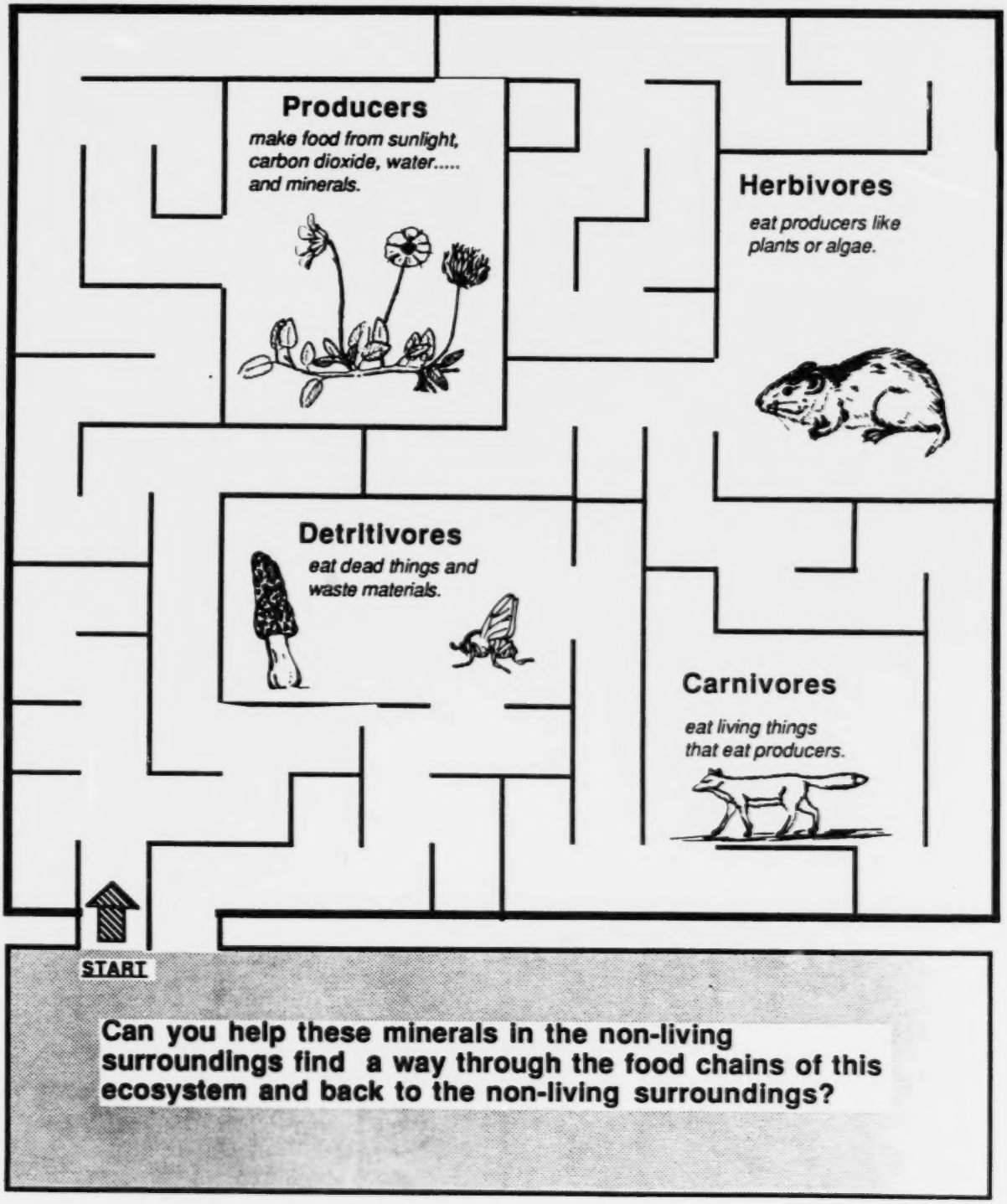
Color and cut out the cards below and put them in order to make 4 different food chains found in Alaskan ecosystems.

and minerals	Kelp I make food from energy and minerals.	Snail I eat kelp.	Dwarf Dogwood I make food from energy and minerals.
Merlin I eat pine grosbeaks.	Pine Grosbeak I eat the berries of dwarf dogwood.	Bacteria I eat wastes. I live in a wetland.	Phalarope I eat mosquito larvae.
Mushroom I eat dead things in forests.	Springtail I eat dead things on the tundra.	and minerals	Sea Star I eat snails.
and minerals	Alpine Sunflower I make food from energy and minerals.	and minerals	Mosquito Larvae I eat algae.
Wolf I eat Dall sheep lambs.	Algae I make food from energy and minerals.	Dall Sheep I eat alpine sunflowers.	Sea Cucumber  I eat wastes in the sea.

Alaska Wildlife Week Unit 4, © 1986 ADF&G

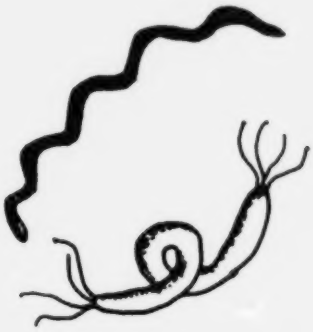
Ecosystem Maze

Name_____



Can you help these minerals in the non-living surroundings find a way through the food chains of this ecosystem and back to the non-living surroundings?

Alaska Wildlife Week Unit 4. © 1986 ADF&G



SCIENCE

Objectives: Students will understand the importance of microscopic decomposers in breaking down waste materials.

Materials: Two samples of soil from a wild area (if possible, get samples from a forest or wetland); 2 slices of banana or other organic material, fine mesh bags.

Procedure: Sterilize one sample by baking it at a high temperature in the oven. (This should kill most of the micro-organisms in the soil.) Be sure to label this sample--Sterilized Soil. Place a banana slice or any kind of organic material in each piece of netting and place1 of these in each of the soil samples. Cover the samples with clear plastic that has a few holes punched in it for air exchange. Set the samples in a warm, moist location and observe what happens. Which sample rots the fastest? Why?

This experiment can also be done in different locations outside. You can use other kinds of organic material--such as dead leaves--but do not choose wood as it decays very slowly. Tie the mesh bags down, so that a larger animal doesn't drag them off. Try using different sizes of mesh--nylon stocking versus an onion bag. Which sample disappears the fastest? (The sample in the large mesh bag will because larger detritivores will have access to the material. They break down the larger particles, then smaller detritivores can more easily break the material down.)

SOCIAL STUDIES

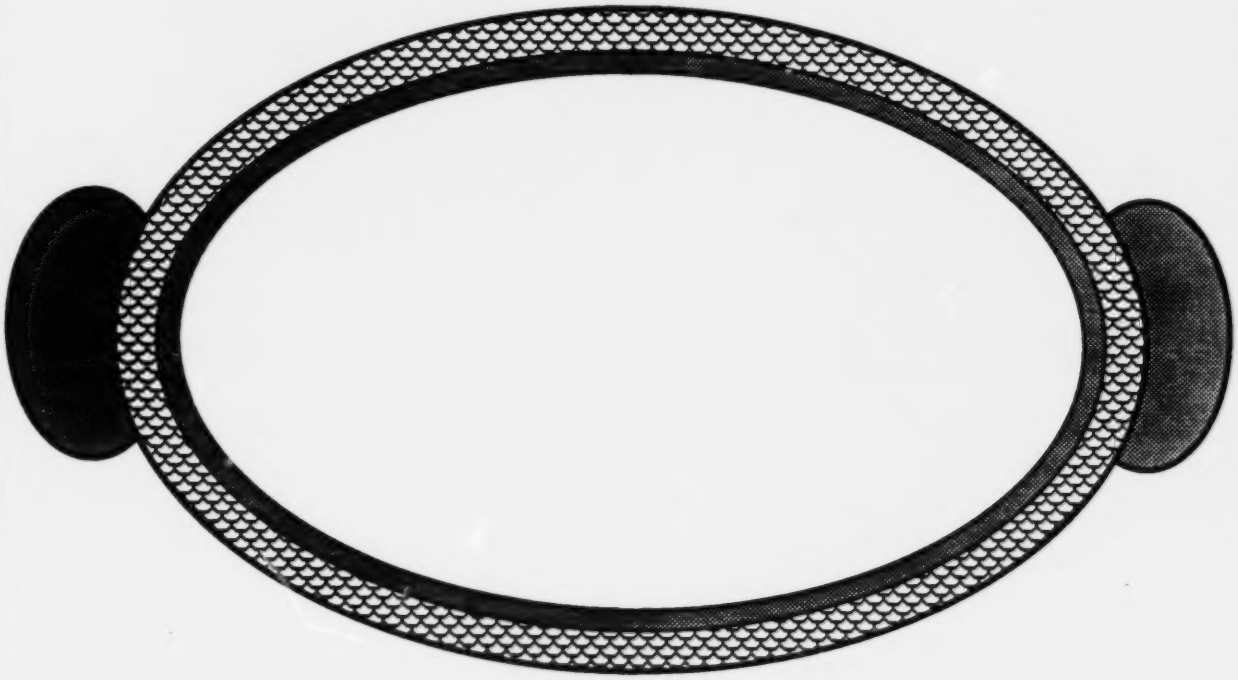
Objectives: Students will recognize that many minerals (materials) used by man could be recycled and thus conserved.

Procedure: Do the introductory lesson and review the importance of detritivores in breaking down the wastes in ecosystems so they can be re-used. Have students do an inventory of the waste materials produced by their household, school, or town. (This could include a trip to the dump and sewage treatment plant.) How are these wastes dealt with now? Are any recycled? Discuss the problem of dealing with waste materials. How long will the waste materials last? Will they ever decay? (Discuss which of the waste materials are made from limited resources (fresh water, oil, gas, aluminum, iron, plastic) as opposed to renewable resources (wood). Which will break down due to natural processes? Discuss whether people will run out of these materials eventually. How could things be changed so that we wouldn't run out of materials? Can we learn anything from ecosystems? Are there any "detritivores" in human communities? Do we need some?

Have students try to design a dump, or system, that would recycle all the garbage produced by their school or community. Encourage them to think of ways to recycle both the organic and inorganic wastes.

MAKE A LINK

Name_____



This is a picture of a

_____

Can this living thing make its own food? yes no

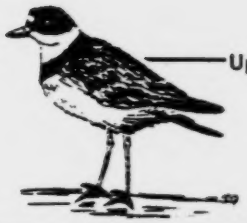
If it can not make its own food, what does it eat?

_____

What living things eat it?

_____

Lesson 4.



Upper Elementary

Students will beble to identify the 5 ways that populations of living things interact: predation, competition, mutualism, commensalism, and parasitism.

Background: As mentioned in the first lesson, ecosystems are made up of the non-living environment and the living things in a particular area. As discussed, every ecosystem includes a wide variety of living things (from monerans to animals) that perform different functions (from producer to detritivore). The particular mix of organisms found in an ecosystem is called a community. The community is made up of all the populations of all the living things in the ecosystem.

The populations of living things within the community interact with and affect each other in a variety of ways. In past lessons, we looked briefly at predation--the interaction that is so important in the exchange of energy and cycling of minerals. The food chains and web of a community show the predation interactions within it. Predation is an activity that occurs between populations of predators and prey. The populations of both players are affected through this interaction.

Predation is just one form of interaction. If we look more closely at any ecosystem, we find that, the populations of organisms in the community interact in other ways, too.

Competition is a kind of interaction that is easiest to see in retrospect. In other words, we can see the results of competition more easily than we can see this interaction occuring. Competition occurs whenever populations of two organisms are using the same resource--food, water, cover, or space--and that resource is in short or limited supply. Basically, competition is a contest. We usually just see the results of the contest-- the population of organisms that win the contest get the limited resource. The losers can not survive without the resource and so they disappear. For example, plants compete with each other for water, soil minerals, and access to sunlight. This kind of competition is easy to see because the plants can not move, and the resources within a small area are very limited. Still, when we look at the plants that occur in an area, we see the results of past competition--the winners remain, the losers are gone. To observe competition in action, we must make several observations of the competing populations over some period of time.

Symbiosis is another kind of interaction between populations of organisms. It literally means "living together". When one kind of living thing needs another kind of living thing in order to survive, these organisms have a symbiotic relationship. In the broadest sense of the word, nearly all of the organisms within a community are symbiotic--most depend in some way on other living things in the ecosystem. Most living things depend on producers, like plants, to make food (and oxygen), and each living thing needs the living things that it feeds on. For example, snowshoe hares need willow plants to eat, and lynx need snowshoe hares (and since snowshoe hares need willows--so do lynx). Most living things also depend on plants (in addition to those they are connected to through food chains) for cover. For, example, neither lynx nor snowshoe hares eat spruce trees, but both depend on the overhanging branches of spruce for shelter from bad weather and protection from predators (in the case of lynx, to protect their kittens from hawks and owls).

Generally, two organisms are considered symbiotic if at least one of the two can not survive without the other. Three types of symbioses are generally recognized: mutualism, commensalism, and parasitism. Mutualism is a kind of symbiosis where both of the organisms involved benefit by living together. Commensalism is a kind of symbioses in which one of the organisms involved benefits, and one is not affected. Parasitism is a kind of symbioses where one of the organisms (the parasite) benefits, while one (the host) is harmed. (Predation might really be considered a form of parasitism--or in some cases, vice-versa. Parasites, in contrast to predators, are generally (though not always) much smaller than their hosts, and usually harm, rather than kill, their hosts.

Vocabulary: *commensalism, competition, interaction, interdependent, mutualism, parasistism, pollination, predation, spore, symbiosis*

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The following are just a few examples of symbiotic relationships between living things in Alaskan ecosystems. Many others are given in the Ecosystem Partners cards in this section.

Pollination is a good example of mutualism. In order to make seeds, many plants need to exchange pollen with other plants. Some plants rely on the wind to carry their pollen, but many kinds of plants depend on animals to perform this important task. The plants that need this help produce colorful, or sweet-smelling flowers and a sugary liquid called nectar. The flowers attract animals, such as bees, butterflies, moths, and hummingbirds, that eat nectar. While sipping the nectar, these animals get a dusting of pollen, which they then carry off to other flowers. (mutualism)

Some plants also need animals to carry their seeds. Some plants produce seeds with small hooks or awns that catch or grab on to animal fur--in this way they get a free ride to a new area. (commensalism) Other plants, like blueberry, dogwood, raspberry, and cranberry, produce edible berries. The animals that eat the berries get the energy and minerals in the berries' fleshy outer coats. The hard-coated seeds inside, however, pass through the animal's digestive tract intact and are deposited in a new area--with a bit of fertilizer. (mutualism).

Many plants (some scientists estimate 80% of all species) are closely associated with certain fungi (mainly mushrooms). The fungi (the underground hyphae of mushrooms) live in or on the roots of the plants. Scientists are still trying to understand the interdependence of the plants and fungi. Apparently, the plant roots give certain foods to the fungi, and the fungi somehow help the plant roots to get certain minerals (such as phosphorus). (mutualism) Many plants depend on nitrogen-fixing bacteria in a similar way. The bacteria live on or in the plant roots and apparently benefit from the safe, moist environment. The bacteria help the plant by taking nitrogen from the air and putting it into the soil where the plant roots can absorb it.

Some living things are so dependent on each other that they can only live together. Lichens are a good example of this. A lichen is actually two separate living things--a fungus and an algae (or a blue-green algae, now called a cyanobacterium) that live together. Although some of the fungi and some of the algae that form lichens can survive independently, many can not live without each other. In addition, by living together, they can live and grow in harsh environments where neither could live alone.

Innumerable examples of parasitism can be found in Alaskan ecosystems--most involve microscopic organisms, or invertebrates. Many organisms are parasitic for only a part of their life cycle. Lamprey fish are a good example of a large parasite. The adults attach themselves to larger fish then suck the blood of their host. The host lives and feed (for itself and indirectly for the parasite) for many months after the lamprey attaches. Botfly lay their eggs on caribou; the larvae get under the animal's skin, and feed on its tissues. They then emerge, drop off, and develop into adults in the ground.

An interesting example of the tangle of symbiotic inter-relationships that can occur within a community can be found in Alaska's forests. Tree and violet-green swallows, chickadees, nuthatches, boreal and saw-whet owls, and flying squirrels nest in holes in dead trees. These animals can not dig their own nest holes. Instead, they have to find a hole that has already been made by some other living thing. These animals usually use holes that were made by woodpeckers. The woodpeckers dig new nesting and roosting holes for themselves each year; their old holes provide homes for the cavity-nesting animals that can't dig their own holes. But, woodpeckers are not able to dig holes in just any dead tree--they can only excavate a hole if the wood is partly decayed or rotted--thus the woodpeckers depend on fungi that rot and decay wood. The fungi, in turn, rely on woodpeckers and squirrels to carry their spores between dead trees. (A spore is a fungi's way of reproducing--similar to a seed.) Also, most fungi can only eat dead wood; these fungi thus rely on other organisms to kill the trees. These include insects that parasitize and kill trees, microscopic organisms that cause tree diseases and large animals, like beavers or porcupines, that kill trees. Obviously, the insects, microscopic disease-causing organisms, beaver, porcupines, fungi, woodpeckers, and cavity-nesting species all ultimately depend on the trees, as well.

Similar examples of inter-twined symbiotic relationships exist in other ecosystems, too. Likely, many still await discovery. Thus, the tangle of interdependencies depicted by food web diagrams may only hint at the complexity of interconnections between populations of organisms within an ecosystem.

Introductory Activity.

Objectives:

1. Students will learn the variety of ways that living things are interdependent.

Materials:

Ecosystem Interactions Cards (see following pages), bulletin board, pins, heading labels for bulletin board:
Predation--One eats the the other;
Competition--They both need the same resource;
Mutualism--They both help each other;
Commensalism--One benefits, the other isunaffected;
Parasitism--One is helped, one is hurt .

Procedure:

1. Explain that the populations of all the kinds of living things that occur in an ecosystem make up a "community" of living things. Have students try to guess why this word is used to describe all the living things in an ecosystem. Do they recognize that all the organisms within the community have certain roles (such as producer, consumer)? Do they guess that since all the living things share the same environment, that they might interact with each other in other ways?

Give examples of animals that live in the same places because they are connected by a food chain. (For example, a lynx wouldn't live where there were no snowshoe hares to prey on, and a hare couldn't live where there were no willows, so we tend to find willows, snowshoe hares, and lynx together.) Review the ways that organisms that are connected through food chains need each other.

2. Explain that living things associate with other living things and are interdependent in other ways too. Can students think of any way that one living thing might need another--besides for eating? Put up the bulletin board headings and inform the class that they are going to play a game to learn about some of the ways that certain living things are interdependent. Pass out the cards, one per student. (If there are more cards than students, you can use the ones most applicable to your area or play more than one round--just be sure that each time you pass out the cards that go together (marked by matching corner patterns). Now explain that each of the living things shown on the cards interacts with one or more other living things. The object of the game is for each student to find theorganism they interact with.

3. Have students circulate amongst themselves to find their partners. (Some students may realize that the patterns match, so don't allow them to compare cards--just ask each other questions.) When students find an organism they interact with, they continue searching together...in some cases 3 or more organisms interact. You may want to limit the search effort to 10 minutes.

4. When all students have found partners, have each group explain to the rest of the class about the organisms on their cards and the interactions of these organisms. Have the group, or the class, decide which category each interaction best fits. (In the groups of 3 or more, categorize each pair of partners separately. For example, the chickadee and woodpecker have a commensal relationship. The woodpecker and fungi have a mutualistic relationship. The beetle and the tree have a parasitic relationship. When the interaction is classified, the group can write the names of the partners under the correct category on the board, and pin their cards in a row on one side of the board. (Or, make extra copies of the cards that match with more than one organism--then students can pin up sets of cards under each category) Once the bulletin board is complete, encourage all students to take time to look at it and see all the different associations.

5. Follow up with the Ecosystems Interactions Worksheet (p38) and curriculum integration activities (p. 39-40).

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ECOSYSTEM PARTNER CARDS

PHOTOCOPY, CUT-OUT, AND LAMINATE

Chickadees nest in small holes in dead trees, but they cannot dig their own nest hole.

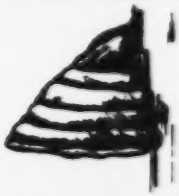
Downy woodpeckers dig out small holes in trees for nesting and roosting. Other small birds can use the holes in the future.

Fireweed needs to have its pollen carried to another fireweed plant. It has nectar to feed the animal that helps it.

Butterflies eat flower nectar. They help plants by carrying pollen between flowers.

Beavers build dams on rivers in order to make big ponds. The ponds they make often drown and kill trees.

Goldeneye ducks need ponds in the forest, and a large hole in a dead tree for a nest. They can't dig their own nest holes.



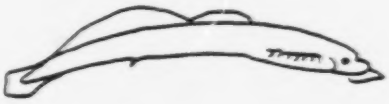
This fungus makes dead wood soft, then eats the wood. but it needs a dead tree.

Flickers dig large holes in dead trees for nesting and roosting, but they can only dig in dead wood that is soft.

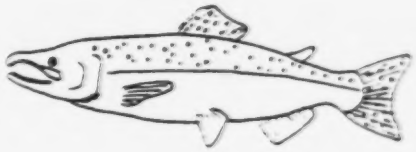
This junco lays its eggs in an open nest on the ground.

This cowbird needs to find the open nest of a small bird so it can lay its eggs. The other birds will mistake the cowbird egg for one of their own. So, they will take care of it. When the baby cowbird gets big it will kill the other chicks in the nest so it can have all the food.

Adult lamprey fish can not catch their own food. The only way they can eat is by attaching themselves to a larger fish and sucking its blood.



Salmon are a large fish.



Arctic foxes can't find any small animals to eat in winter. They like to eat seal meat but they are too small to kill a seal. They need another animal to kill seals for them.

Polar bears are very large predators. They kill seals and leave a lot of scraps that other animals can eat.

This birch tree needs many minerals from the soil, but its roots can't get enough minerals. It can make food to give to the living thing that helps its roots get minerals.

The underground parts of this mushroom can help the roots of a tree get minerals from the soil.

This barnacle eats tiny animals and algae that live in sea water. As an adult, it needs to attach to the skin of an animal that can carry it around the sea to good feeding places.

This whale eats small animals that live in the sea. It has a lot of skin and travels hundreds of miles around the ocean to places where the water is full of tiny animals and algae.

These caterpillar larvae change into pupae. The pupae are encased in a shell and do not move or feed. If they survive, they will become adult butterflys.

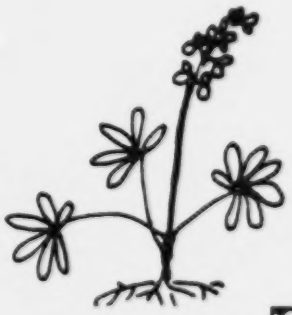
caterpillar larvae pupae adult

This wasp needs to find a butterfly pupae in order to lay its eggs. When the wasp larvae hatch, they burrow into the pupae. The shell-like case protects them from predators and they eat the butterfly pupae.

This hermit crab needs a strong shell to protect it from predators.

When this snail dies, its body will be eaten by other living things, but its shell is made of strong material so it could make nice home for some other animal.

Lupine can only get nitrogen from the soil, but this mineral isn't in the soil where this plant is growing.



This microscopic living thing, called a bacteria, can take nitrogen from the air and put it into the soil.

Merlins live in coniferous and mixed forests. They eat small birds that live in this habitat.

Pine grosbeaks live in coniferous forests.

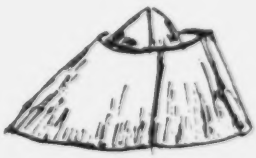
Algae are microscopic organisms that live in water.

Mosquito larvae live in the water and feed on microscopic organisms in the water.

Brown bears feed mainly on the roots of plants and berries. They also eat ground squirrels, fish, and moose and caribou calves, and dead things.

Black bears feed mainly on the roots of plants, and berries. They also feed on fish, and they will eat small animals, and any kind of dead animals.

In order to feed and survive, blue mussels must attach themselves to rocks along a wave-washed shore.



In order to feed and survive, barnacles must attach themselves to rocks along a wave-washed shore.

ECOSYSTEM INTERACTIONS

Name_____

_____

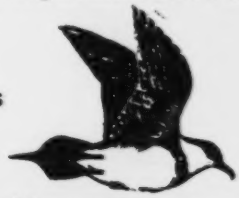
Match the following words.

In this interaction.....	one species.....	and the other species...
a.___ Parasitism	i. struggles.....	also struggles
b.___ Predation	b. benefits.....	also benefits
c.___ Competition	o. benefits.....	is killed
d.___ Commensalism	m. benefits.....	is harmed
e.___ Mutualism	s. is not affected.....	benefits

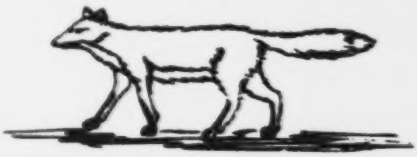
Name the kind of interaction that occurs between the underlined organisms listed below.

1._____

Malophaga are a kind of arthopod that live on and eat the feathers of birds, such as jaegers. Due in part to the Malophaga, jaegers must molt and grow new feathers regularly.



2._____



Both red foxes and coyotes eat small mammals, birds, and bird eggs.

3._____

The tentacles of this anemone are green because of the green algae that live inside its arms. The anemone's stinging tentacles protect the algae from predators; the algae produces oxygen and possibly some sugars that the anemone can use.

4._____

This adult dragonfly lives by catching and eating adult mosquitos.

5._____

In Alaska, merlins usually nest in old, abandoned magpie nests.

6._____

Goldeneye ducks nest in holes of dead trees that are in or near ponds made by beavers.

The interactions described in 1, 3,5, and 6 above are examples of

Y

d a e c b d c d

SCIENCE LANGUAGE ARTS

Objectives: Students will practice memory and listening skills and become more familiar with the inter-relationships of living things.

Materials: Ecosystem Interactions Cards

Procedure: This activity is for a station or group of 3-5 students. The dealer shuffles the Interactions cards together, and deals a hand of 5 cards to each student. The object of the game is to find sets of cards that show living things that interact. When a student gets a set of two or more that go together, they discard the set in front of them. At the end of the game the student with the highest number of discarded cards (not sets) wins. On each turn, a player asks one other player for a specific card by saying: I have a.... Do you have something it interacts with? If the player that is asked has a card of something does interact, then they must say what the organism is and what it does, then turn the card over to the other player. That player then makes a set, names the kind of interaction, and if correct, discards the set to his/her pile. If the player successfully discards, they get to ask for some other card. If a player draws the correct card, but names the interaction incorrectly--another player may get the set and the extra turn by challenging, and correctly identifying the interaction. When a player is unsuccessful, they draw a card and the turn passes to the next player. Students should try to remember who has what cards in order to find the ones needed for a set. There are some sets of 3 or more. A player with 2 cards in such a set should discard them on their turn by laying them down and naming the interaction. Any player who gets a third card that goes with a set of 2 that has been discarded, can discard their matching card to their pile opn their turn by specifying and naming the interaction. If they do not discard a matching card, and another student realizes the match, they can ask for the card and discard it to their pile. Game ends when all the cards are discarded.

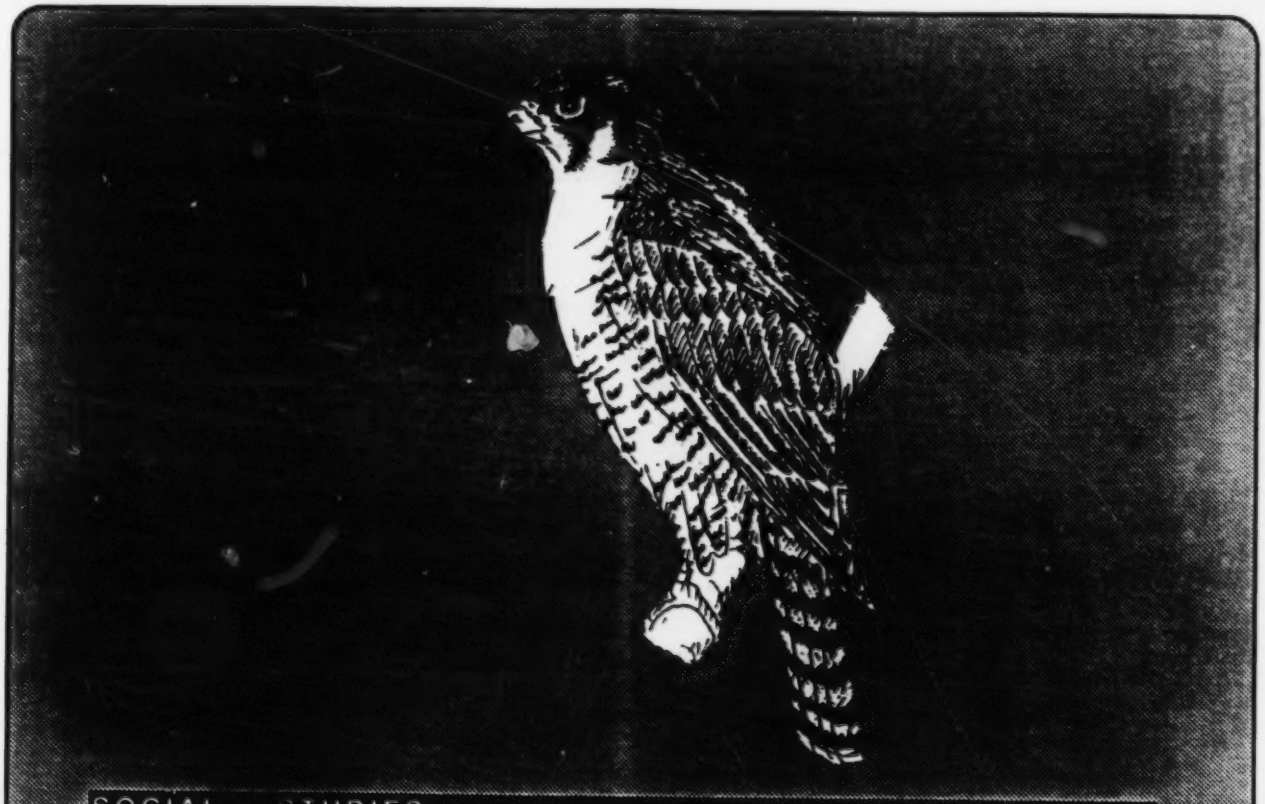
SCIENCE

Objectives: Students will strengthen their understanding of that all living and non-living things in an ecosystem are inter-connected, by drawing a picture using a single line.

Materials: Various works of art that convey ideas or feelings, paper and pencils.

Procedure: Discuss the idea that art can be used to convey ideas. Have the class look at several different kinds of artwork and discuss what the artists showed in their pictures. Have students tell what they see, think of, or feel when they look at various pictures--happpy, sad, cold, warm, lonely?

Now explain that they are going to try to make drawings that will convey the idea that ecosystems are made up living and non-living things and the inter-connections of these. Review the non-living and living things that make up ecosystems. Then review the ways that the non-living environment and living things are interconnected by food chains and webs, and by living things that need each other (symbioses). Explain that since all the parts of an ecosystem are interconnected, they are going to draw a picture of an ecosystem using just one line--so that everything in the ecosystem will be interconnected. Ask them to put their pencil down in one corner of their paper. Then, close their eyes and imagine an ecosystem. They do not have to draw everything in their ecosystem but they wil need to draw some of each of the kinds of things that occur in an ecosystem. Tell them to keep their eyes closed, and just draw without lifting their pencil from the paper. Ask them to think first of the non-living environment and draw in some of the non-living things they see in their mind--the air, water, rocks, soil, the sun, or clouds..... Then, ask them to continue drawing--don't look or lift your pencil from the paper--and add some living things--how about a microscopic organism; a fungi (suggest a mushroom, shelf fungus, mold, or lichen). Ask them to draw in some of the plants they see in their ecosystem (trees, shrubs, herbs, mosses, or ferns). (Keep re-iterating that they are not to look or lift their pencil from the paper. Finally they need to add the animals. Have them draw in 3 or 4 animals that they see in their ecosystem (insects? birds? mammals? fish?).



SOCIAL STUDIES

Objectives: Students will recognize that humans are interdependent with other living things, too.

Procedure: Review briefly that all living things do certain things that are important to other living things that live in the same ecosystem. Have students give some examples. All the living things in an ecosystem are sometimes called a community--the same word that is used to describe a place where people live together. Ask students whether or not humans do things that are important for other people that live in the same community? Have students name as many jobs done by people as they can think of. (baker, teacher, garbage collector, house builder, etc.) List these in column 1 on the blackboard. Label column 2, Non-living things and column 3, Living things. Then, go through each job listed and discuss whether the person doing the job needs things from the non-living environment (if so, list these in column 2) or other living things (if so, list in column 3), in order to do their job. When finished with this, ask students whether they think their human community could survive without the surrounding ecosystem. They should recognize that most of the jobs people do require things from the non-living environment or other living things--i.e. ecosystems.

Discuss this idea further. Are there any jobs done by living things in the ecosystem, that people can't do? (Make oxygen and food!, change waste materials back into minerals (we can do this with some materials by burning them) make soil, wood, rubber, certain medicines.) Students should recognize that humans are dependent on other living things for food, oxygen, mineral recycling, and materials for building. Are humans part of the ecosystem?

Lesson 5.

—Upper Elementary

Students will recognize that in order to conserve any kind of wildlife, we must conserve all the non-living and living things in the ecosystem to which it belongs.

Background: The many inter-relationships between living things, and between living things and the non-living environment make ecosystems both resilent and fragile. Any change in the non-living surroundings, or in a population of any living thing, is likely to cause many other changes within an ecosystem. Changes in the non-living surroundings can affect all living things, because all use air, water, and minerals, and are affected by temperature, humidity, and light. A change in a population of one living thing will affect the populations of all the other living things it interacts with--through food chains and webs, or other kinds of interactions. The resulting changes in these populations, may in turn, affect the populations of all of the different living things these interact with. This chain reaction of changes means that a single change--in the non-living surroundings or in the population of a single kind of living thing--can indirectly affect many, or all, the living things in that ecosystem.

Ecosystems can and do tolerate and absorb changes in the non-living environment (such as weather and climatic changes, earthquakes, floods, etc.). Ecosystems can also tolerate and absorb changes in the numbers and kinds of living things present; extinction of certain species and invasion by others are natural and, over geologic time, constant occurrences. All ecosystems are in a state of constant change.

However, too many or severe changes in either the non-living surroundings, or the populations of living things can cause an ecosystem to fall apart. While such a collapse may make the area uninhabitable for its present residents, species with adaptions suitable for the changed environment may colonize and become established. After a long period of time, a new ecosystem may thus appear--with a whole different community of living things interconnected by different food webs and symbioses. In the long run, the collapse of an ecosystem may only be undesirable from the standpoint of survival of the particular organisms that were adapted for and dependent on the original ecosystem.

However, from a practical standpoint, we humans must be concerned the chain reaction of changes that can occur within ecosystems. We must be concerned if we are interested in conservation of any specific kind of wildlife, and if we are interested in human welfare. For the survival of every species (including the human species) depends not only on protection of its populations, but also on protection of the entire ecosystem in which it lives.

For example, in order to protect salmon, we must not only protect them, but also their non-living surroundings, and all the organisms they depend on. The non-living surroundings the salmon need include the stream water and gravel beds where the salmon eggs are laid and hatched, and the sea where the salmon grow to adult size. It also includes the stream's tributaries, the river the salmon use to migrate to and from the sea, and the rain water that forms the stream and river. The living things needed include those that produce the oxygen salmon need to breathe (phytoplankton and aquatic plants). It includes the shrubs and trees that grow beside the stream providing cover, and the shade that moderates stream temperatures. Also included are the living things the salmon eat--from the stoneflies and other aquatic insects they eat as larvae, to the herring and sand lance they eat as adults. It also includes the organisms the prey feed on--(dead plant materials (largely from the streamside trees and shrubs) and zooplankton, respectively). Finally, it also includes the organisms those depend on. (The plants depend on detritivores to recycle minerals, and may depend on animal pollinators and/or seed carriers, and on fungi or bacteria to help them obtain certain minerals; the zooplankton need phytoplankton.) Thus, if we intend to conserve salmon populations, we must also conserve all the parts of the ecosystem in which they live.

Vocabulary: *consequences*

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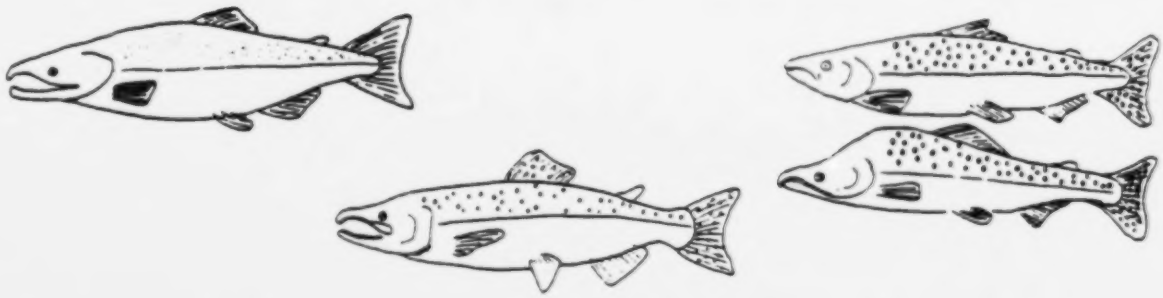
Upper Elementary

People are often thought of as somehow separate from the surrounding wilds, but like all other living things, humans are a part of the earth's ecosystems. We need water, minerals, and air from our non-living surroundings. We need plants and algae to produce oxygen and maintain the composition of our atmosphere. We also need these producers to make food for animals and ourselves. We also depend on plants to reduce soil erosion, moderate our climates, and maintain the water cycle. We depend upon nitrogen-fixing bacteria and denitrifying bacteria to maintain the nitrogen cycle. We need bacteria and fungi to break down waste materials and recycle the raw materials needed by plants. About 80% of the biomass created by photosynthesis is ultimately broken down by detritivores--without them, all that biomass (leaf litter, dead animals, fecal wastes, etc.) would just accumulate! Humans also need certain chemicals produced by bacteria, fungi, and other organisms as medicines. And we need many of the materials made by plants (and animals) for clothing, shelter, and machinery (for example, wood, paper, cotton, silk, wool, rubber, certain oils). We also depend on predators, parasites, and disease-causing micro-organisms to keep populations of other organisms in check.

Clearly, we humans depend upon our non-living surroundings and other living things. We are a part of the earth's ecosystems. Thus, changes in the earth's ecosystems affect us as well as all other living things. Our worldwide population of over 4 billion humans is causing changes in most ecosystems of the world. Nearly every human activity affects ecosystems. Each change may have desirable or undesirable consequences. The important thing to recognize is that every activity has potential consequences. Even an activity that seems only to affect insects, or fungi, the upper atmosphere, or ground water supplies can have far-reaching consequences. We must be careful to ensure that the effects on the earth's ecosystems of any given human activity (or the cumulative effects of several activities) will be effects that we want--and that we can, very literally, live with.



Introductory Activity.

Objectives:

Students will learn that in order to protect any kind of wildlife, we must protect their non-living surroundings and all the other living things they depend upon.

Materials:

Large open area with grass or carpeting; reference materials on wildlife (may be able to do without).

Procedure:

Have the class nominate animals for the title "Our Favorite Animal," then take a vote to choose one. Assign 2 or 3 students to represent the favorite animal. Have the class list the parts of the non-living surroundings that their favorite animal needs--assign one student to represent each of the parts.

Have the class name the living things their favorite animal eats (write these on the board)--assign students to represent each of these. Have students list 2 things eaten by each of these animals (again write on the board), and assign students to represent those. Have students list 2 or 3 living things that make the oxygen needed by their favorite animal; write these on the board and assign one student to represent each one. Determine if there are other living things that help any of the living things so far listed (don't forget pollinators, seed carriers, etc.). List these on the board, and assign students to represent them.

Now , choose one of the least popular living things listed (or have the class vote on their least favorite animal--from those listed on the board.) Does the class think it would matter if people did something that caused that unpopular living thing to die out? (For example, if humans spread a poison that killed that organism, or destroyed its habitat.)

Explain that they are going to play a game to find out. Have students stand (or squat) in a circle on the grass or carpeted area. They represent parts of an ecosystem--but they are not yet an ecosystem, because they are all standing alone. In order to represent an ecosystem, they all must become interdependent. Ask them to place their hands on the shoulders of the person next to them. Then everyone should take a step toward the center of the circle and take the hand of the person just beyond the person next to them. (Hands should be grasped behind the back of the person next to each student.) Then have everyone lean back, knees straight, and walk their feet in toward the center. Then ask the student representing the unpopular living thing to let go. What happens? Was their favorite animal affected? Have the class discuss why we would need to protect all the living things listed on the board in order to protect their favorite animal.

Have the class make bumper stickers that say: Help save (name of their favorite animal), Protect (name of their least favorite living thing). Or have the class adopt the unpopular species. (Instead of adopting whales--adopt amphipods. Or instead of adopting hawks--adopt voles) Students can make posters, write poems, paragraphs, or banners declaring the importance of their unsung wildlife hero.

Follow-up by having students choose thier own favorite animal and complete the My Favorite Living Thing Worksheet. Evaluate student understanding with the with the Who Needs Who Worksheet (p.45).

Help save the peregrine falcon....
Protect Cranefllies!

Alaska Wildlife Week Unit 4. © 1995 ADF&G

SOCIAL STUDIES

Objectives: Students will be able to explain the importance of less well-known or unpopular organisms, and will be able to describe the U.S. political process. (Accomplished by holding a school-wide election for most important living thing.)

Materials: art supplies for making bumper stickers, posters, buttons, costumes, etc.; reference materials for student research would be useful but are not imperative.

Procedure: (Before doing this activity, do the introductory lesson , so that students have a clear understanding of the ecosystem importance of less well recognized living things.)

Have students organize and hold a school-wide election for the Most Important Living Thing. You may want to assign students in your class to try to get a less well known or unpopular organism elected, or this same end might be accomplished by setting up the appropriate political parties. You could have 5 "political" parties perhaps--the Monerans, Protists, Fungi, Plants, and Animals--or the Nitrogen-Fixers, the Producers, the Herbivores, the Detrtivores, and the Carnivores. The first step is to hold party caucuses where preliminary nominations are made. At this step you may want to just involve your classes, but the final election should include the whole school. (You may want to have students dress in costumes and play the roles of the nominees.) The caucuses would be followed by campaigns for the party nominations, and culminate in party conventions. Assistant Important Living Thing running mates for the party candidates should be selected at the conventions. Then hold the full-blown party campaigns, complete with speeches, posters, radio and TV ads, bumper stickers, buttons, and debates by the candidates. Students representing the candidates could dress up like the nominated organisms and visit other classrooms to give speeches on why they should be elected. (Other organism "heavyweights" (or symbiotic species) could dress up and proclaim their support for various candidates, too) Then finally, hold the election--complete with an electoral college if you wish!
FOLLOW-UP with a discussion of the difficulties of communicating complicated issues, the effectiveness of campaign slogans, and the effects of appearance, charisma, name recognition, etc. on election results.

My Favorite Living Thing

Name_____

_____

(fill in the name of your favorite living thing)

This living thing depends upon:

_____ _____ _____ _____

(its non-living surroundings)

_____ _____ _____ _____

(the living things that make the oxygen it breathes)

_____ _____ _____ _____

(the living things that help the producers)

_____ _____ _____ _____

(the living things that my favorite living thing eats)

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

(the living things that each of these eat)

_____ _____ _____ _____

(any living things needed by any of the above living things)

In order to protect my favorite living thing, we are going to have to protect the __ __ __ __ __ __ __ __ __ __ to which it belongs.

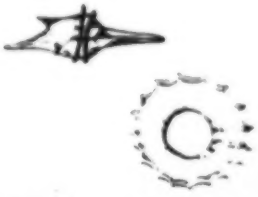
Alaska Wildlife Week Unit 4. © 1985 ADF&G

Who Needs Who

Name _____

_____

_____

We want to conserve populations of this animal.	Circle all the living things that we'll need to conserve, if we want to protect the animal listed in the first column.
chickadee	woodpecker fungi tree insects
wolf	plants insects dall sheep certain bacteria and fungi
weasel	vole berry-producing plant fungi
harbor seal	fish  tiny animals that live in the sea algae

Alaska Wildlife Week Unit 4. ©1986 ADF&G

ART

Objectives: Students will review the parts of an ecosystem and their interconnections by making a 3-dimensional model of the ecosystem around them.

Materials: A wide variety of art materials, such as construction, butcher, and crepe paper, scissors, glue, staples, paint, masking tape, and clay.

Procedure: Review the concept of an ecosystem and the variety of living and non-living things that occur in every ecosystem. Then ask students to convert the classroom, or a portion of the room) into an ecosystem. Review the various kinds of art techniques students have used during the year and encourage them to be creative in thinking of ways to portray living and non-living things. You may want to assign one group each to construct models of animals, plants, fungi, protists (seaweeeds, algae, and protozoans), and non-living things. Or assign more specific groups(birds, mammals, mushrooms, lichens, trees, flowering plants, etc.) to individual students. Challenge students to portray representatives of all the living and non-living things in the ecosystem. They can observe or use references to find out the variety of things that occur. Encourage students to create models that portray the colors, textures, and size of the things they portray.

To evaluate the model, choose individual animals and help the class determine whether the ecosystem includes all the things they need to survive. Use the questions given in the introductory activity for a guide. If not, have students add the missing items. If desirable, you can have students show all the ecosystem interconnections using lengths of string.

When the ecosystem is complete, your students can invite another class in for a nature walk. Your students can be the naturalist/guides. Assign individual naturalists to show and tell the visiting students about the parts of the ecosystem (non-living environment and living things), the producers and their importance, ecosystem food chains, and organisms that need each other for other reasons.

SCIENCE MATH ART

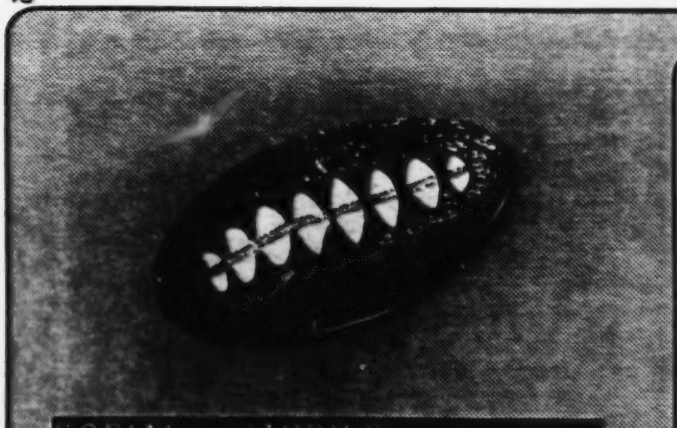
Objectives: Students will recognize that human activities affect ecosystems by comparing areas with and without human disturbance.

Materials: Access to two outdoor sites-- one undisturbed site, and one affected by human activities, (a playground, parking lot, or lawn is adequate, but you may want to choose a site that is affected by an activity such as logging, mining, or agriculture), 11 x 17 drawing paper, pencils, crayons, clipboards or other drawing surface.

Procedure: Each student should be given a large sheet of drawing paper (11 x17). Have them fold the paper in half to form two 81/2 x 11 sheets; label one half--A Wild Ecosystem--and the other side, The Ecosystem after People Changed It. Visit the undisturbed site first, and have students walk around to look for animal sign and explore first. Then have them sit down and observe the area right where they are sitting. Then ask them to draw a picture of the ecosystem they see on the half of their paper labeled A Wild Ecosystem. Guide them through the drawing by having them first draw and color the non-living environment. Encourage them to note the exact color of the sky, the air, the water, and the soil.

Then ask them to count the number of different kinds of producers (plants and algae) that they see (record this number) then draw the producers into their picture. Then, have them look for animals or their sign (make sure they examine the ground for droppings and insects, and plant leaves and stems for signs of browse and for insects). Count up the number of different kinds found, then have students draw these into their pictures. As a last step, have them look for fungi, count the different kinds, then add them to their drawings. Then, have them turn their papers over and go to the disturbed site and repeat the above steps.

When students have completed the two drawings, have them open up their folded papers to show their two pictures side by side. Discuss the differences, if any, in the color of the air, water, and soil at the two sites. Use the numbers that you recorded to have students make bar graphs of the numbers of animals, producers, and fungi found at each site. Have students compare what the bar graphs show to what they show in their drawings. Then discuss the differences in the number and kinds of producers, animals, and fungi at the two sites.



SOCIAL STUDIES

Objectives: Students will recognize that human actions can harm ecosystems.

Procedure: (If you keep the information from the introductory activity on the board, you can skip the second step of this activity--just draw lines to show the interconnections of the various living and non-living things listed).

1. Have the class make a list of all the things that people do around your area. Discuss how each of these activities might directly affect the non-living environment (air, water, and soil), or living things (plants, animals, fungi, microscopic organisms)? Write the effects on the board next to the activity. (See the background section for examples).

2. Choose an animal that lives in your area, then have students list the living and non-living things needed by this animal. (Does the animal drink water? Breathe the air? Does the animal breathe oxygen made by the plants? Which living things does it eat? Does it depend on other living things? List the different things it needs on the board and draw lines to connect these to the animal. Then, have students figure out what each of the listed living things needs. (Do the plants need soil? sunlight? water? pollinaters? seed carriers? decomposers to recycle minerals? What do each of the living things eat--do they depend on other living things?) List these and draw lines to show connections.

3. Review the list of things people do that affect living and non-living things. How many of the activities affect something that is connected to the animal of concern by lines? These activities could affect populations of that animal. Students should recognize that everything humans do can affect living things. Discuss and compare the effects of one person doing a certain activity, and 100, 1000, or 4 billion people doing that activity.

MUSIC

Objectives: Students will strengthen their understanding that all the parts of an ecosystem are important, by comparing an ecosystem to a symphony.

Materials: Recordings of the sounds of a variety of instruments; a recording of an orchestra (or band) of those instruments playing a symphony (or modern music)

Procedure: Have children listen to examples of each of the instruments being played individually. Then, ask them to listen to the symphony. Ask students what instrument played the symphony? Do they realize it was made by many instruments playing together. Have the children listen again and try to pick out the different instruments that are combining to play the symphony. Could any single instrument make the symphony music? How would the symphony sound if some instruments were removed.

Have the class compare an ecosystem to an orchestra. How are they similar? (All the players (instruments / organisms) are a part of the whole (orchestra / ecosystem)--each does something different, but all are important.) Does the beauty we perceive when looking at a forest, tundra, ocean, or wetland compare at all to the beautiful sounds of a symphony?

Divide the class into groups and assign each group to figure out the sounds or motions made by non-living things or certain living things in the ecosystem around them. The group assigned to non-living things might think of the sounds made by the wind, water rushing, or thunder.) Assign other groups to represent plants, birds, mammals, fungi, protists, and monerans (or make up your own groups). These groups can think of sounds or motions that these organisms actually make, or just choose certain sounds or insturments to represent them.

Write the names of the groups in a column on the board. Explain that each group will sound off, or show its motions when a line shows in their row. Write a "musical score," with short and long lines to show when the various groups are to "play." Students can help--you may want the score to represent a day (dawn, morning, afternoon, etc.; or the seasons) Then, you, the conductor, keep time so that all the groups know where on the score the "orchestra" is during their ecosystem symphony. (You can vary the "musical score" to demonstrate a variety of rhythms, or types of music.)

ECOSYSTEM INVESTIGATION--
Ideas for studying the outdoors

The following pages are included to encourage you to get students outdoors to see and observe an ecosystem first hand. Each section includes suggestions on how to look for, and find, a variety of living things. All of the suggested equipment, excepting a microscope and binoculars, can be jerry-rigged from materials or supplies that are easily available. Students are likely to be amazed at the variety and abundance of living things just outside the door. (You might try some of the same experiments inside,too. How many fungal spores are right in your classroom?)

You can join with another teacher to set up study stations for students, or take several trips outside and do one investigation at a time. Some field guides are listed below. Additional references are listed on the inside of the back cover of this guide. See also the Materials Guides that were in the 1983-1985 Alaska Wildlife Week materials (which should be in your library.)

Don't hesitate to ask local experts for help in identification and appreciation of the ecosystem. Many biologists,naturalists, and sportsmen are happy to help students learn more about the outdoors.

ECOSYSTEM INVESTIGATION--THE NON-LIVING SURROUNDINGS

INVESTIGATING THE SOIL---Dig a small hole in the ground so that students can see a cross-section of the soil 30 cm (about12 inches) deep. Note that the has soil layers that look different in color or texture Soil color tells much about the make-up of the soil. The more organic matter in the soil, the darker brown or black it is. Large amounts of iron will make the soil appear reddish or orange, while large amounts of copper will give it a greenish tint. Soil texture: Wet a sample of soil from the top layer and rub it between your fingers. How does it feel? Grainy? Spongy? Slippery? If it feels grainy, it has a lot of sand in it. If it feels spongy, it has a lot of organic material. If it feels slippery it is a clay soil.

In part, the amount of water in the soil depends on how recently it rained or the snow melted, but the make-up of the soil is also very important. Soils with a lot of organic matter hold more water than soils without organic matter. Clay soils also hold a lot of water, but they bind it so tightly that most plants can not use it. Plants have to have water to absorb minerals from the soil. Plants grow best in soil that is rich in organic matter, but also well drained so that detritivores can break down the organic material and make it available to the plants. Sandy, organic soil provides these conditions.

INVESTIGATING THE AIR--Encourage students to note the color and smell of the air. The amount of nitrogen, oxygen, carbon dioxide, and other gases in the air are impossible to measure unless you have very sophisticated equipment. However, a simple test will show students how much dust and pollen are in the air. Spread petroleum jelly on several cards then place them in a variety of places (on a tree, building, near the ground, along a road). Leave the cards out for a day. Then examine the cards carefully.

INVESTIGATING THE WATER--Encourage students to note the presence or absence of water, and the amount of area covered by water, and whether the water is moving or not.

INVESTIGATING THE ENERGY--Students can find out roughly the amount of light energy in a particular location by holding up a solid object (such as a book) and noting the kind of shadow it casts. If the shadow is sharply defined, there is a lot of light. If the shadow is hard to see, there is a moderate amount of light. If you can't see any shadow, there is little light. (If you have a light meter (or a camera with a light meter) you can take a measurement of the amount of light. Encourage students to note that light levels are higher out in the open, away from tall plants. Have them compare the numbers and kinds of plants in sites with high and low light levels.

Have students measure the temperature of the air, the soil (at the surface and under the surface), the water. Encourage them to compare the temperatures of the air, soil, and water indifferent areas.

ECOSYSTEM INVESTIGATION--Monerans and Protists

LOOK FOR SIGNS--All individual monerans and many protists are microscopic, but en masse, it is possible to see some kinds. A scum on the surface of the water is a good sign that bacteria or blue green algae (or cyanobacterium) are present. A greenish or brownish slimy coating on an old log or on a rock is evidence of cyanobacterium or algae. Many bacteria help to decay dead leaves. Look for a dead leaf that has decayed so that all that is left is a fine meshwork of veins. That is evidence of bacteria at work.

LOOK FOR THE ORGANISMS--In order to see microscopic organisms, you need to use a microscope. Collect samples of soil, water, moss, tree bark, and dead leaves. Place a tiny bit of each one on a microscope slide, and add a drop of water. Examine the slide under high power.

ASK EXPERTS--A microbiologist is a scientist who studies microscopic living things. You might find one at a university, offices of the State of Alaska Dept. of Environmental Conservation, U.S. Environmental Protection Agency, or local health service. You could ask them about the bacteria, cyanobacterium, algae and other protists of your area. They might have pictures or samples of some they could show you.

HOW ABUNDANT ARE THEY-- Count the number of organisms on each slide you prepared and record this. Multiply the number of monerans and protists on a single slide times the number of slide samples in a tablespoon to estimate how many microscopic organisms are in a tablespoon of soil.

ECOSYSTEM INVESTIGATION--Fungi

LOOK FOR SIGNS--Most fungi help to decay or rot dead organisms and waste materials. Look for evidence that a log is decaying, or leaves are rotting away.

LOOK FOR THE ORGANISMS--You are likely to find fungi anywhere that dead plants are found. They are more likely to be growing in a moist spot. Look for old dead trees. Examine an old log carefully. Dig into the leaf litter on the ground. You are looking for anything that is spongy (mushrooms and shelf fungus), that looks like dust (a mold), or like a clear or milky jelly (a slime mold). Examine any that you find with a hand lens. A special type of fungi grow together with certain algae and cyanobacterium to form lichens. These can be found just about anywhere. Look for them on the surface of rocks, on tree branches, and on the ground. An easy way to recognize a lichen is that it is brittle and easy to break if it is dry, but will gradually become flexible if you wet it.

TRY TO GROW SOME FUNGI--Many kinds of fungi are hard to find except during certain seasons when they send out fruiting parts that produce their spores. A mushroom is an example of a fruiting part of a fungi. The fungi is there growing underground all year round but you may only see mushrooms in late summer. You may be able to grow some of the fungal spores that are around(see the diagram below).

ASK EXPERTS--A mycologist is someone who studies fungi. You might find a mycologist at a local university.

HOW ABUNDANT ARE THEY? Count the number of fungi that you can see in a 50 cm square area. (Since some fungi may only be found in certain seasons, you might want to come back and take the same measurement at different times of year.)

HOW TO MAKE A FUNGI GARDEN

1. Mix up a growing medium. Boil 1 quart of water. Add 11/2 tablespoons of malt (same kind that is used in milkshakes) and 1 package of unflavored gelatin. Stir constantly until mixture boils. Boil 1 minute. Pour into several small jars or dishes. Cover well with plastic and let sit until mixture gels.

2. Set the dish of growing medium out in your plot. Remove the cover and leave it for 24 hours. Replace the plastic cover. Place the entire unit in a warm moist place and observe what happens during the next week.

ECOSYSTEM INVESTIGATION--Animals in the Soil

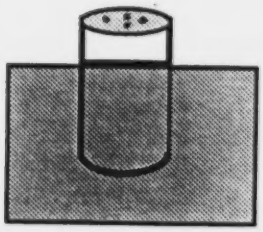
LOOK FOR SIGNS--Many kinds of animals, including insects, snails, spiders, isopods, and small mammals live underground. If studentsu just glance at an area they may not notice that any are present. Have students examine a 1m x 1m area carefully. Look for small holes or tunnels into the ground, droppings, or leaves that seem to have a bite taken out by a small animal.

LOOK FOR THE ORGANISMS--Use an empty can as a sampling tool. Have a student press the open end into the soil until the can is at least half full of soil. Mark the can so you will know later how much soil you collected. Take the soil back to the classroom in a plastic bag. You can place it in a tray and sort through it. Or, set up the Berlyse funnel shown on the right. Leave the light on overnight. Many of the living things in the soil will move away from the warm bright light and fall into the collecting bottle.

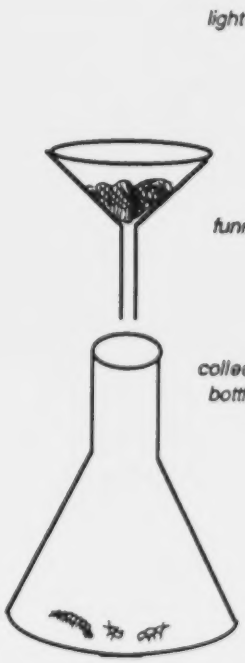
ASK EXPERTS--An invertebrate biologist is a scientist who studies animals that do not have backbones (like insects, mollusks, crustaceans, and worms). Entomologists are scientists who study insects. Either of these kinds of scientists could probably tell you some of the organisms that are found in the soil and they might be willing to help your students identify the ones they find. They might also have specimens for students to look at. You might find such a scientist at a local university, an office of the U.S. Dept. of Agriculture (includes the U.S. Forest Ser- vice), or the State of Alaska, Division of Agriculture.

HOW ABUNDANT ARE THEY? 1. Find out how much soil students collected. (Fill the sampling can up with water to the same level as the soil sample. Measure how much water this is in milliliters using a graduated cylinder--or a measuring cup.) One milliliter equals 1 cubic centimeter. 2. Count the number of organisms you found in the sample. By dividing this number by the number of cubic centimeters of soil sampled, you can find out how many soil organisms there were per cubic centimeter of soil.

Soil Sampler



Berlyse Funnel

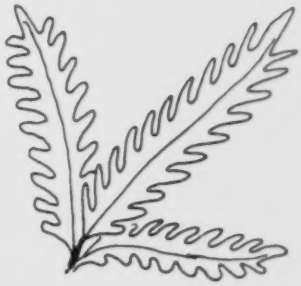


ECOSYSTEM INVESTIGATION--Plants

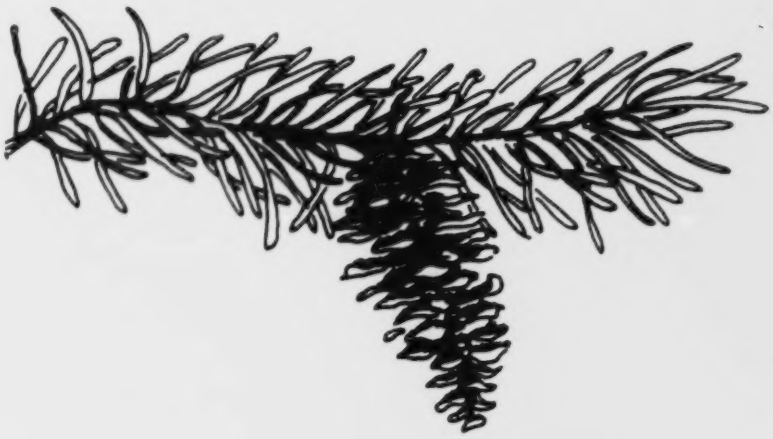
LOOK FOR SIGNS--Depending on the time of year and where you are, many plants may be dormant--so students won't see their leaves, flowers, or even stems. They might find it interesting to find out what plants are in the soil as seeds. Take a small sample of soil back to the classroom, or collect a variety of seeds from the ground and take them along with the soil. Put the soil in an open container (an old milk carton, for example). Then, water the soil well, cover it with plastic and place it in a sunny spot. Watch closely for 2-3 weeks.

LOOK FOR THE ORGANISMS--Plants are probably the easiest living things to observe and study. Students can see them easily and they can't move away. But it is easy for students to overlook the number and variety of plants unless they look carefully. Be sure they look for mosses, ferns, and horsetails as well as conifers and flowering plants (see the poster if you don't know what these are).

ASK EXPERTS--Scientists who study plants are called botanists. You can find botanists at universities and at the State Dept. of Forestry and U.S. Forest Service. Most biologists can identify plants, so you might check with the Alaska Dept. of Fish and Game or U.S. Forest Service for help. Local nature clubs may have people who are interested in, or study plants, too. They might be able to help you identify some of your plants.



HOW ABUNDANT ARE THEY-- Have students count the number of each kind of plant that students found in a 1 m x 1 m area and record this number next to the drawing of that plant. Be careful to count individual plants, not every individual leaf or stem.



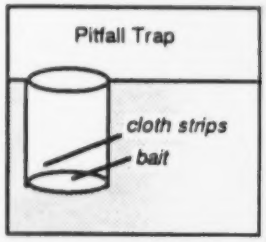
LOOK FOR SIGNS--Often, it isn't easy to see the birds and mammals that live in an area. Many move around over large areas and try to stay hidden. But they leave signs of their presence. Look for animal droppings, tracks, hair or feathers, plants that have been nipped or browsed, nests or dens. A book that will help you identify animal sign is A Field Guide to Animal Tracks by Olaus J. Murie.

LOOK FOR THE ORGANISMS--The most important thing to remember when you are looking for birds and mammals is to be quiet--talking and moving around noisily will scare them away. Sit quietly, listen and watch. Try to visit the site in early morning or late evening. Bring binoculars or a spotting scope, if you can.

ASK EXPERTS--Wildlife biologists study birds and mammals. An ornithologist studies birds and a mammalogist studies mammals. You might find these kinds of scientists at your local Alaska Dept. of Fish and Game or U.S. Fish and Wildlife Service office. Or, check with local nature clubs; members of organizations like the Audubon Society may know a lot about the birds and mammals of your area. Sportsmen's groups are also a good source of information; trappers and hunters may know a lot about some of the mammals in the area. State and federal park departments may also have biologists or naturalists on their staff.

CHECK REFERENCES--A good way to find out more about the wildlife in your area is to check books about wildlife, like the Guide to Birds of Alaska by R.W. Armstrong, and A Guide to the Mammals by William H.Burt and Richard P. Grossenheider.

LIVE TRAPPING-- You can live trap shrews and other small mammals by making pitfall traps. Dig a small hole in the ground and set in a small coffee can so that its top edge is even with the ground. Bait with a mixture of peanut butter, bacon fat, and oatmeal. Be sure to put cloth strips or cotton in the bottom of the can so any animal you capture can make a nest and stay warm. Checkyour traps at least every 12 hours. If traps are checked less frequently, the animals you catch may die.



HOW ABUNDANT ARE THEY? Measure a 10m x 10m area, then count the number of each species that you find in that area. Count any sign you see as 1 animal, unless it is clear that there was more than one. For example, if you found 2 sets of moose tracks--one much larger than the other, that would show that there were two moose in the area. But if you found two sets of tracks, both the same size, it could have been the same animal passing through twice. Compare your estimate of bird and mammal abundance with other groups. Could you get a better estimate of abundance using everyone's estimates? Biologists spend a lot of time and money trying to develop accurate ways of counting birds and mammals. You may want to invite local experts to come to your class and discuss with students how they count, or census, wildlife.

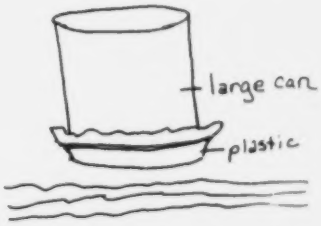
ECOSYSTEM INVESTIGATION--Animals in the Water

LOOK FOR THE ORGANISMS--You can make the underwater viewer shown at right with a coffee can and some clear plastic. Put it on the water surface and look under water for fish, insect larvae, worms, or other creatures. Pick up rocks and look on the underside of them. (Be sure to put them back in the same place so the animals that live there will still have their home.)

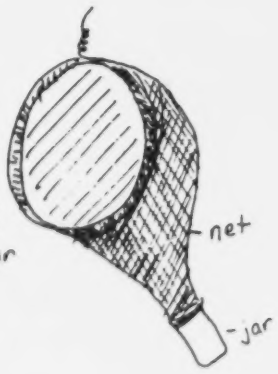
CATCH THE ORGANISMS--The diagrams below show a variety of ways that you can catch animals that live underwater in order to look at them more closely. Be sure to return them to their homes after examining them. Check your library for books on identifying insects and other invertebrates.

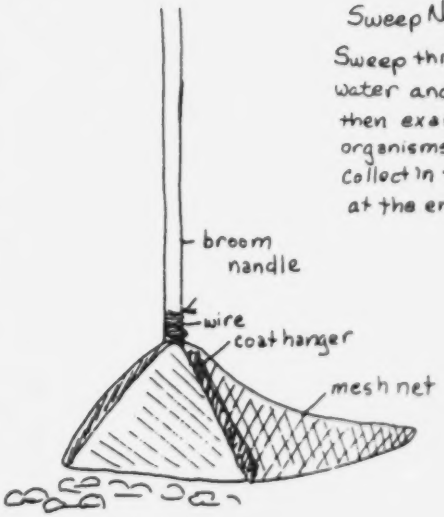
ASK EXPERTS-- You can find fisheries biologists at your local Alaska Dept. of Fish and Game or U.S. Fish and Wildlife Service office. Since fish eat the other kinds of living things in the water, fisheries biologists will likely be able to help you identify the insects and other invertebrates, too.

MEASURING THE ABUNDANCE OF AQUATIC INVERTEBRATES-- Measure the volume of water, or bottom sediment that you collected. Then, count the number of organisms in the sample. Or count the number of organisms found per sample collected. Or, have students count the number of organsims found per rock they turned over.



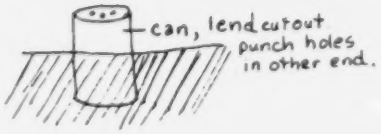
Underwater Viewer





Kick Sampler

Place on bottom of a stream. Kick stream bottom gently. Examine.



Core Sampler

Push down into bottom of stream or pond, then pull up. Sort through sample.

*Check the 1984 Alaska Wildlife Week, Unit 2. Water, Wetlands, and Wildlife for more information and instructions on making and using some of the above sampling equipment.

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A GUIDE TO THE FIVE KINGDOMS OF LIVING THINGS

The information below is provided as background information for teachers on the 5 major groups of living things--their characteristics and ecological roles. This 5 kingdom classification has replaced the older division of living things into two kingdoms--plants and animals. See the poster that accompanies this packet for illustrations of representative organisms. (Much of the information presented in this table was modified from "Biology," 4th ed., by Helena Curtis, Worth Publishers, New York.)

Kingdom Monera

This kingdom includes the smallest and most primitive living things, bacteria and cyanobacteria (formerlly called blue-green algae). All monerans are made up of only one cell. Some monerans live together in colonies (as filaments for example) and thus may superficially appear to be multicellular organisms. These microscopic organisms are differentiated from all other living things by the lack of a cell nucleus. The genetic material of monerans floats freely in their cell fluids. They do not have mitochondria or chloroplasts. Most monerans absorb their foods (nutrients), but some are capable of photosynthesis. Most monerans reproduce asexually by fission or budding. Monerans are very important ecologically as decomposers; cyanobacteria are important producers. Many monerans are symbionts with other living things. Certain bacteria live in the intestinal tracts of animals and help digest foods, or produce needed nutrients. Some bacteria live in or on the roots of plants and help them absorb nutrients from the soil. Some cyanobacteria and fungi form lichens. Some bacteria cause diseases in plants and animals.

Kingdom Protista

This kingdom includes nearly all other single-celled organisms (including algae and protozoans), slime molds (which have many cell nuclei with in a single cell) and multicellular algae (the seaweeds or kelp). (Brown, green, red, golden-brown, and fire algae; diatoms and dinoflagellates belong to this kingdom). This kingdom includes only organisms with a cell nucleus. Algae (both single celled and multicellular) are very important producers, particularly in aquatic ecosystems. Some protozoans can do photosynthesis, while others are consumers; some protozoans obtain nutrients using photosynthesis and by consuming other living things. Protists move by use of flagella, cilia, or pseudopodia; some kindsdo not move from place to place.

Kingdom Fungi

This kingdom includes organisms that have a cell nucleus. Most are made up of filaments of cells, but a few aresingle-celled. It includes mildews, morels, truffles, mushrooms, toadstools, shelf fungi, yeasts and molds. Lichens are made up of a fungi living together with an algae or cyanobacteria. All fungi obtain food (nutrients) by absorbing it. Many fungi are extremely important as decomposers. They give off certain enzymes that break down organic material (dead organisms and waste materials), then absorb the nutrients broken down by their enzymes. Other fungi, particularly mushrooms are very important because of their symbiotic relationships with plants, or mycorrhizal. Mycorrhizal fungi live on or in the roots of plants and in exchange for nutrients from the plant root, they help the plant absorb minerals from the soil. Other fungi are parasitic, on plants or animals (athlete's foot for example). We often just see the reproductive part of fungi (for example, a mushroom); the main part, tiny thread-like extensions called hyphae, extend inside and through the wood, soil, leaf litter, roots, or other material on which the fungi is growing. Fungi reproduce asexually by spores, and sexually.

Kingdom Plantae

This kingdom includes mosses, liverworts, ferns, horsetails, conifers, and flowering plants. These organisms are characterized by having cells with nuclei and a cell wall; and the highly organized arrangement of their many cells. All are capable of photosynthesis, and most are green. All except the mosses and liverworts have leaves, roots, and stems and a system for transporting water and organic materials among the many cells. Plants are extremely important ecologically in their role as the major producers in terrestrial ecosystems. All plants live a stationary life.

Kingdom Animalia

This kingdom includes sponges, jellyfish, hydra, and anemones; flatworms; molluscs (snail- and clam-like organisms, chitons and octopi); segmented worms; other worms; arthropods (horseshoe crabs, spiders, crabs shrimp, centipedes; millipedes and insects); bryophytes (moss animals); starfish, sea urchins, and sea cucumbers; lamprey, sharks, rays, fish, amphibians, reptiles, birds, and mammals. These are all characterized by having cell nuclei, lacking a cell wall, and the highly organized arrangement of their many cells. All animals obtain energy and minerals by eating other living things; they are consumers. Most animals move around alot.

ALASKAN FOOD CHAIN AND FOOD WEB EXAMPLES

Six food chain examples for forest, tundra, wetland and ocean are shown in bold letters. Make food webs by using the other foods of each living thing (listed in small letters below its name) to find other interconnections. Use with the activities in Lessons 1, 2, and 3 of this unit. Use information provided on the back of the photo poster (from this and Alaska Wildlife Week Units 1, 2, & 3--check your library). See the 1984 unit for more background on wetland food webs.

	PRODUCER	HERBIVORE	CARNIVORE 1	CARNIVORE 2	DETRITIVORE
FOREST	**1. White Spruce**	**Red Squirrel** berries, mushrooms	**Marten** voles, bird eggs		**Mushroom** any dead plant
	2. Willow	**Snowshoe Hare** birch, grass, fireweed	**Lynx** voles, squirrels		**Raven** any dead animal
	3. Grass Seeds	**Red-backed Vole** berries, fireweed	**Boreal Owl** flycatcher, woodpecker		**Fly** any dead animal
	4. Lingonberry	**Pine Grosbeak** spruce and birch seeds	**Goshawk** squirrel, flycatcher, woodpecker		**Bacteria** any dead thing
	5. Fireweed	**Moth**	**Alder Flycatcher** flies, beetles	**Merlin** pine grosbeak	**Beetle** any dead animal
	6. White Birch	**Bark Beetles** spruce	**Downy Woodpecker** moth, berries		**Shelf Fungus** any dead wood
TUNDRA	**1. Lichen**	**Caribou** dryas, willow, sedge	**Brown Bear** sedge, grass, blueberry		**Bacteria** any dead thing
	2. Dryas	**Dall Sheep** willow, sunflower, sedge	**Wolf** caribou, marmot		**Raven** any dead animal
	3. Willow	**Redpoll** willow, sunflower, sedge	**Arctic Fox** singing vole, any dead animal		**Flies** any dead animal
	4. Grass	**Singing Vole** sedge, sunflower, dryas	**Short-tailed Weasel** redpoll		**Springtail** any dead plant
	5. Sunflower	**Butterfly** blueberry, mountain avens	**Golden Plover** flies, springtail, blueberry	**Jaeger** redpoll, vole	**Bacteria** any dead thing
	6. Sedge	**Marmot** grass, sunflower	**Wolverine** fox, any dead animal		**Mushroom** any dead plant
	7. Blueberry	**Willow Ptarmigan** willow, sedge	**Golden Eagle** marmot, weasel, sheep (lamb only)		**Fly** any dead animal
WETLAND	**1. Algae**	**Water Fleas** dead plants, protozoans	**Stickleback** midge, rotifer	**Common Loon** frog	**Bacteria** any dead thing
	2. Pondweed	**Pintail** algae, seeds of sedges	**Peregrine Falcon** phalarope		**Rotifer** any dead producer, protozoans
	3. Algae	**Midge** algae, dead plants	**Wood Frog** flies, mosquitos	**Sandhill Crane** stickleback, sedges	**Water Flea** any dead producer, rotifer
	4. Sedges	**Muskrat** pondweed	**Mink** stickleback, phalarope		**Bacteria** any dead thing
	5. Willow	**Moose** willow, sedge	**Wolf** muskrat, pintail		**Flies** any dead animal
	6. Algae	**Mosquito Larvae** protozoans	**Red Phalarope** midge, water flea, rotifer	**Parasitic Jaeger**	**Protozoans** any dead material, algae
OCEAN	**1. Green Algae**	**Sea Urchin** kelp	**Sea Otter** crab, sculpin, sea star		**Tanner Crab** any dead animla
	2. Kelp	**Snails** green algae	**Sea Star** sea urchin, sea cucumber, shrimp		**Flatfish** any dead animal, snails, fish
	3. Diatom (algae)	**Amphipod** other algae, kelp	**Sculpin** shrimp, sand lance	**Sea Anemone** sand lance, snails	**Shrimp** any dead material
	4. Sea Grass	**Brant** green algae	**Bald Eagle** herring, guillemot, any dead animal		**Marine Worm** any dead plant, algae
	5. Brown algae	**Copepods** other algae, sea grass	**Sand Lance** amphipod, euphausids	**Pigeon Guillemot** sculpin, herring	**Sea Cucumber** any dead thing
	6. Red algae	**Euphausids** other algae, diatoms	**Herring** copepods, sand lance	**Harbor Seal** sand lance, flatfish	**Gull** any dead animal

Reference List

The following references were used in preparing this Alaska Wildlife Week Unit. These references are organized to allow the reader to find further information about living things and ecology. References that will be particularly useful to teachers are preceded by an asterisk.

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